MONTANA BIOENERGY GUIDEBOOK

- ALCOHOL FERMENTATION
- ANAEROBIC DIGESTION
- COGENERATION
- Ddensification
- DIRECT COMBUSTION
- GASIFICATION
- LANDFILL GAS
- LIQUEFACTION
- OILSEED EXTRACTION
- PYROLYSIS

S
333.9539
N7MBG
1991

MONTANA STATE LIBRARY
R 333.9539 N7mbg 1991 @S 333.9539 N7mbg
Montana bioenergy guidebook /
3 0864 00077988 7

ABBREVIATIONS AND ACRONYMS

ARM	Administrative Rules of Montana
ASCS	U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service
ASME	American Society of Mechanical Engineers
BACT	Best Available Control Technology
BATF	U.S. Department of the Treasury, Bureau of Alcohol, Tobacco, and Firearms
BBER	Montana Bureau of Business and Economic Research, University of Montana
BIA	U.S. Department of the Interior, Bureau of Indian Affairs
BLM	U.S. Department of the Interior, Bureau of Land Management
BOD	Biological Oxygen Demand
BPA	U.S. Department of Energy, Bonneville Power Administration
Btu	British Thermal Unit
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
cwt	Hundredweight
DDGS	Distillers' Dried Grains
DFWP	Montana Department of Fish, Wildlife and Parks
DHES	Montana Department of Health and Environmental Sciences
DNRC	Montana Department of Natural Resources and Conservation
DOA	Montana Department of Agriculture
DOC	Montana Department of Commerce
DOE	U.S. Department of Energy
DOJ	Montana Department of Justice
DOLI	Montana Department of Labor and Industry
DOR	Montana Department of Revenue
DOT	Montana Department of Transportation
DSL	Montana Department of State Lands
EA	Environmental Assessment
EARC	Eastern Agricultural Research Center
ED	Montana Department of Natural Resources and Conservation, Energy Division
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EQC	Environmental Quality Council
F	Fahrenheit
FERC	U.S. Federal Energy Regulatory Commission
gpm	Gallons Per Minute
H_2	Hydrogen
H_2S	Hydrogen Sulfide
ICC	Interstate Commerce Commission
LAER	Lowest Achievable Emission Rate
MACT	Maximum Available Control Technology
MASS	Montana Agricultural Statistics Service
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act
MGWPCS	Montana Groundwater Pollution Control System
MPDES	Montana Pollutant Discharge Elimination System
MSW	Municipal Solid Waste
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_x	Compounds of Nitrogen and Oxygen
NPDES	National Pollutant Discharge Elimination System
O_2	Oxygen
O_3	Ozone
OSHA	U.S. Occupational Safety and Health Administration
PAH	Polyaromatic Hydrocarbons
PER	Preliminary Environmental Review
PM-10	Particles With an Aerodynamic Diameter of 10 Microns or Less
POM	Particulate Organic Matter
PSC	Montana Public Service Commission
PSD	Prevention of Significant Deterioration
psi	Pounds Per Square Inch
QF	Qualifying Facility
RCRA	Resource Conservation Recovery Act
SHWB	Montana Department of Health and Environmental Sciences, Solid and Hazardous Waste Bureau
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_x	Compounds of Sulfur and Oxygen
TSP	Total Suspended Particulates
UIC	Underground Injection Control
USDA	U.S. Department of Agriculture
USFS	U.S. Department of Agriculture, Forest Service
VOC	Volatile Organic Compounds
WQB	Montana Department of Health and Environmental Sciences, Water Quality Bureau

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

MONTANA BIOENERGY GUIDEBOOK

Prepared by

Raelen Williard
Information Specialist
Information Now

information now

and

Howard E. Haines, Jr.
Biomass Program Engineer

DNRC

MONTANA DEPARTMENT OF NATURAL
RESOURCES AND CONSERVATION
1520 EAST SIXTH AVENUE
HELENA, MONTANA 59620-2301
(406) 444-6697

DECEMBER 1991

ACKNOWLEDGMENTS

This guidebook is a revised version of *Montana's Bioenergy Project Permitting Guidebook*, published by the Montana Department of Natural Resources and Conservation (DNRC), July 1986. A number of individuals contributed to the development and production of this publication, including: Raelen Williard, Information Now, Helena, Montana, author and research and information services; Howard E. Haines, Jr., DNRC, author and project manager; Carole Massman, DNRC, editor; Dan Vichorek, DNRC, assistant editor; and Barbara Lien, DNRC, desktop publishing technician.

A special thank you goes to all of the individuals in businesses and local, state, and federal agencies who provided information for this publication.

NOTICE

This guidebook was prepared with the support of DNRC and the U.S. Department of Energy (DOE), Pacific Northwest and Alaska Biomass Energy Program administered by the Bonneville Power Administration (BPA). Such support does not constitute an endorsement by BPA or DNRC of the views expressed in this work. Any opinions, findings, or conclusions presented in this guidebook are those of the preparers. Neither BPA nor DNRC assumes any responsibility for economic losses resulting from the use of this guidebook. No warranty, expressed or implied, is made for the accuracy, completeness, or usefulness of the information found herein.

Every project is unique, and it is recommended that this guidebook be used as a starting place to learn about and understand the planning and permitting process for bioenergy projects. Some permits, licenses, or areas of compliance that are not included in the guidebook may be necessary to a particular project. Finally, the guidebook is not a substitute for working closely with local, state, and federal agencies during the development of a project.

The information in this guidebook was developed from written and oral communications with each regulatory agency. Regulatory statutes and programs are periodically changed. Thus, information presented here is subject to change or reinterpretation.

Permission is granted for reprinting material from the *Montana Bioenergy Guidebook* provided that DNRC, Pacific Northwest and Alaska Biomass Energy Program, and Bonneville Power Administration are contacted and credited.

Cover of this guidebook is printed on recycled paper.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS ..... Inside front cover

ACKNOWLEDGMENTS ii

NOTICE ii

GLOSSARY ix

SECTION 1. WHERE TO START

Introduction 1
How to Use the Guidebook 1
What is Biomass Energy? 2
How to Plan a Bioenergy Project 2

SECTION 2. BIOENERGY TECHNOLOGIES

Introduction 9
Alcohol Fermentation 12
Environmental Permits
Construction and Land Use Permits
Special Issues
Anaerobic Digestion 16
Environmental Permits
Construction and Land Use Permits
Special Issues
Cogeneration 19
Environmental Permits
Construction and Land Use Permits
Special Issues

Densification 22
Environmental Permits
Construction and Land Use Permits
Special Issues
Direct Combustion: Boilers and Furnaces 25
Environmental Permits
Construction and Land Use Permits
Special Issues
Gasification 28
Environmental Permits
Construction and Land Use Permits
Special Issues
Landfill Gas 31
Environmental Permits
Construction and Land Use Permits
Special Issues
Liquefaction 33
Environmental Permits
Construction and Land Use Permits
Special Issues
Oilseed Extraction 35
Environmental Permits
Construction and Land Use Permits
Special Issues
Pyrolysis 37
Environmental Permits
Construction and Land Use Permits
Special Issues

SECTION 3. ENVIRONMENTAL CONSIDERATIONS

Introduction 39
Air Quality 39
Overview
Air Quality Laws and Regulations
Prevention of Significant Deterioration (PSD)
Nonattainment
Air Toxics
PM-10 Standards
Waste Management 47
Solid Waste Disposal (Nonhazardous)
Hazardous Waste Disposal
Water Quality 50

SECTION 4. PERMITS BY CATEGORY

Introduction 51
Agriculture 52
- Commodity Dealer's License
- Feed Dealer's Permit
- Warehouseman's License

Air Quality 54
- Air Quality Permit
- Open Burning Permit
- Prevention of Significant Deterioration (PSD) Review

Alcohol Production 56
- Alcohol Fuel Producer's Permit
- Alcohol Distributor's License

Building, Mechanical, Electrical, and Plumbing Permits 57
- Building Permit
- Mechanical Permit
- Electrical Permit
- Plumbing Permit

Forest Clearing and Burning 59
- Fire Hazard Reduction/Certificate of Clearance
- Timber Removal Permit

Land Use 60
- Floodplain Development Permit
- Lakeshore Development Permit

Major Facility Siting 61
- Certificate of Public Need and Environmental Compatibility

Occupational Safety and Health 62
- Boiler Operating Certificate
- Boiler Operator's License
- Fire Safety Inspections

Waste Management 63
- Hazardous Waste Management Facility Permit
- Solid Waste Management System License

Water Quality 65
- Montana Groundwater Pollution Control System (MGWPCS) Permit
- Montana Pollutant Discharge Elimination System (MPDES) Permit
- National Pollutant Discharge Elimination System (NPDES) Permit
- Stream Protection Act Permit
- Streambed and Land Preservation Permit (310 Permit)

Water Use 68
- Beneficial Water Use Permit

SECTION 5. SPECIAL CONSIDERATIONS

Business Licensing Requirements 71
Cogeneration and Small Power Production 71
Dam Safety 72
Forested Areas 73
Highways/Transportation 73
Indian Reservations 74
Local Areas 74
Navigable Waters 75
Occupational Safety and Health 75
Urban Areas/Municipalities 76
Water Use 77

APPENDIX A. MONTANA BIOENERGY FACILITIES

Projects Listed by Technology 79
Alcohol Production Facilities
Biogas Facilities
Combustion Facilities
Wood Pellet Plants
Projects Listed by Location 82

APPENDIX B. AGENCIES/ORGANIZATIONS 83

APPENDIX C. BIOMASS RESOURCES

Introduction 93
Wood Resources 93
Agricultural Resources 94
Solid Waste Resources 94

REFERENCES AND SELECTED BIBLIOGRAPHY 105

INDEX 117

MONTANA ENERGY COST COMPARISON CHART ..... Inside back cover

FIGURES

1. How To Plan a Bioenergy Project 4
2. Permit Calendar 5
3. Alcohol Fermentation 13
4. Anaerobic Digestion 17
5. Cogeneration 20
6. Densification 23
7. Direct Combustion 26
8. Gasification 29
9. Landfill Gas 32
10. Liquefaction 34
11. Oilseed Extraction 36
12. Pyrolysis 38
13. Maximum Allowable Emission of Particulate Matter from New Fuel-Burning Installations 41
14. Montana PSD Class I Areas 45
15. Areas With Forest Residue Potential 95
16. Areas of Surplus Straw 101
17. Areas With Safflower Production Potential 102
18. Areas With Canola Production Potential 103

TABLES

1. Bioenergy Technologies 10
2. Information Sources for Bioenergy Technologies 11
3. Alcohol Fermentation Permits, Licenses, and Special Issues 14
4. Anaerobic Digestion Permits, Licenses, and Special Issues 18
5. Cogeneration Permits, Licenses, and Special Issues 21
6. Densification Permits, Licenses, and Special Issues 24
7. Direct Combustion Permits, Licenses, and Special Issues 27
8. Bioenergy Technologies and Potential Environmental Emissions 40
9. Air Pollutants Regulated by the State of Montana 42
10. Montana and National Ambient Air Quality Standards 44
11. Areas Exceeding National Ambient Air Quality Standards 47
12. Permits That Might Be Required for Bioenergy Technologies 51
13. Available Bark and Sawdust 94
14. Information Sources for Biomass Availability 96
15. Potential Ethanol Production (in Gallons) From Distressed Grains Based on a Percentage of Total Harvest 97
16. Total Straw Available (in Dry Tons) After Conservation 99
17. Municipal Solid Waste Available by County 104

GLOSSARY

Acid hydrolysis: A chemical process in which acid is used to convert cellulose or starch to sugar.

Alcohol: A general class of hydrocarbons that contain a hydroxyl group (OH). In this guidebook, the term "alcohol" is used interchangeably with the term "ethanol," even though there are many types of alcohol. (See *Butanol*, *Ethanol*, and *Methanol*.)

Ambient air quality: The condition of the air in the surrounding environment.

Anaerobic: Pertaining to the absence of free oxygen.

Anaerobic digestion: A biochemical degradation process that converts complex organic materials to methane and other coproducts in the absence of free oxygen.

Attainment area: A geographic region where the concentration of a specific air pollutant does not exceed federal standards.

Avoided costs: The incremental costs to an electric utility of electric energy or capacity or both which, but for the purchase from the qualifying facility or facilities, such utility would generate itself or purchase from another source.

Backup electricity (backup services): Power and/or services that are only occasionally needed, i.e., when on-site generation equipment fails.

Best available control technology (BACT): That combination of production processes, methods, systems, and techniques that will result in the lowest achievable level of emissions of pollutants from a given facility. BACT is an emission limitation determined on a case-by-case basis by the permitting authority. It may include fuel cleaning or treatment, or innovative fuel combustion techniques.

Biochemical conversion process: The use of living organisms or their products to convert organic material into fuels.

Bioenergy: The conversion of the complex carbohydrates in organic matter into energy, either by using the matter directly as a fuel or by processing it into liquids and gases that are more efficient.

Biogas: A combustible gas derived from decomposing biological waste. Biogas normally consists of 50 to 60 percent methane.

Biological oxygen demand (BOD): The amount of dissolved oxygen required to meet the metabolic needs of anaerobic microorganisms in water that is rich in organic matter, such as sewage.

Biomass: Any organic matter that is available on a renewable basis including forest and mill residues, agricultural crops and wastes, wood and wood wastes, animal wastes, livestock operation residues, aquatic plants, and municipal wastes.

Biomass energy: Biomass fuel, energy, or steam derived from the direct combustion of biomass for the generation of electricity, mechanical power, or industrial process heat.

Biomass fuel: Any liquid, solid, or gaseous fuel produced by conversion from biomass.

Board feet (BF): Unit of measure for logs and lumber equal to a board 1 inch thick, 12 inches wide, and 12 inches long. The material is commonly measured in thousand board feet (MBF) or million board feet (MMBF).

Boiler: Any device used to burn biomass material and wastes to heat water for generating steam.

British thermal unit (Btu): A unit of heat energy equal to the heat needed to raise the temperature of one pound of water one degree Fahrenheit.

Butanol (butyl alcohol): An alcohol with the chemical formula $CH_3(CH_2)^3OH$. It is formed during anaerobic fermentation using bacteria to convert the sugars to butanol and carbon dioxide.

Canola: A winter rapeseed developed in Canada that produces an edible oil low in saturated fat.

Capital cost: The total investment needed to complete a project and bring it to a commercially operable status.

Cellulose: The main carbohydrate in living plants, forming the skeletal structure of the plant cell wall. The carbohydrate molecule is composed of long chains of glucose molecules. Cellulose molecules are much larger and structurally more complex than starch molecules, which makes the breakdown of cellulose to glucose more difficult.

Char: The remains of solid biomass that has been incompletely combusted, such as charcoal if wood is incompletely burned.

Chemical oxygen demand (COD): The amount of dissolved oxygen required to combine with chemicals in the water, usually for industrial wastewater.

Class I area: Any area designated for the most stringent protection from future air quality degradation.

Class II area: Any area where air is cleaner than required by federal air quality standards and designated for a moderate degree of protection from air quality degradation. Moderate increases in new pollution may be permitted in Class II areas.

Cogeneration: The technology of simultaneously producing electric energy and other forms of thermal or mechanical energy from a single facility for industrial or commercial heating or cooling purposes.

Combustion: The transformation of biomass into heat, chemicals, and gases through chemical combination of hydrogen and carbon in the wood fuel with oxygen in the air.

Densification: A process that compresses biomass (usually wood waste) into pellets, briquettes, cubes, or densified logs by subjecting it to high pressure.

Distillation: The process by which the components of a mixture (e.g., ethanol-water) are separated by boiling and recondensing the resultant vapors.

Distillers' dried grains (DDGS): The dried distillers' grains coproduct of the grain fermentation process, which may be used as a high-protein animal feed.

Emissions: Substances discharged into the environment as waste material, such as discharge into the air from smokestacks or discharge into the water from waste streams.

Enzymatic hydrolysis: A process by which enzymes (biological catalysts) are used to break starch or cellulose down into sugar.

Ethanol (ethyl alcohol): An alcohol compound with the chemical formula CH_3CH_2OH formed during sugar fermentation by yeast.

Fermentation: The biological conversion by yeast of sugar into carbon dioxide and alcohol.

Forested areas or land: Any land that is capable of producing or has produced forest growth or, if lacking forest growth, has evidence of a former forest and is not now in other use.

Furnace: An enclosed chamber or container used to burn biomass in a controlled manner where heat is produced for space or process heating.

Gas shift process: A process where carbon monoxide and hydrogen react in the presence of a catalyst to form methane and water.

Gasification: A chemical or heat process used to convert a feedstock into a gaseous form.

Gasohol: Registered trade name for a blend of 90 percent (by volume) unleaded gasoline with 10 percent ethanol.

Hogged (hog) fuel: Wood residues processed through a chipper or mill to produce coarse chips for fuel. Bark, dirt, and fines may be included.

Incinerator: Any device used to burn solid or liquid residues or wastes as a method of disposal. In some models, provisions are made for recovering the heat produced.

Kilowatt-hour (Kwh): A measure of energy equivalent to the expenditure of one kilowatt for one hour, equal to about 3,412 Btus.

Landfill gas: Gas that is generated by decomposition of organic material at landfill disposal sites. The gas generated is approximately 50 percent methane.

Leachates: Liquids derived from or percolated through, and containing soluble portions of, waste piles. Leachate can include various minerals, organic matter, or other contaminants and can contaminate surface water or groundwater.

Liquefaction: The process of converting biomass from a solid to a liquid. The conversion process is a chemical change that takes place at elevated temperatures and pressures.

Liquid hydrocarbon: One of a very large group of chemical compounds composed only of carbon and hydrogen. The largest source of hydrocarbons is petroleum.

Megawatt (MW): An electric generation unit of one million watts or 1,000 kilowatts.

Methane: An odorless, colorless, flammable gas with the formula CH_4 that is the primary constituent of natural gas.

Methanol (methyl alcohol): An alcohol with the chemical formula CH_3OH. Methanol is usually produced by chemical conversion at high temperatures and pressures.

Mill residue: Wood and bark waste produced in processing lumber.

Nonattainment area: A geographic area in which the quality of the air is worse than that allowed by federal air pollution standards. Prevention of significant deterioration requirements do not apply in nonattainment areas.

Oilseed extraction: The separation of vegetable oil from seeds (safflower, sunflower) by the combination of pressing a portion of the oil out and dissolving the remainder of the oil with solvents.

Opacity: The extent to which smoke or particles emitted into the air obstruct the transmission of light.

Organic: Of, relating to, or derived from living organisms; of, relating to, or containing carbon compounds.

Organic compounds: Chemical compounds based on carbon chains or rings and also containing hydrogen with or without oxygen, nitrogen, and other elements.

Particulate: A small, discrete mass of solid or liquid matter that remains individually dispersed in gas or liquid emissions, such as aerosol, dust, fume, mist, smoke, and spray. Each of these forms has different properties.

pH: A measure of acidity or alkalinity of a solution that numerically equals 7 for a neutral solution. Acid solutions have a lower pH approaching 0, and alkaline solutions have a higher pH approaching 14.

Prevention of significant deterioration (PSD): A planning and management process for air quality that applies when a new source of air pollution is proposed in an area where ambient air quality is better than applicable standards.

Producer gas: Fuel gas high in carbon monoxide (CO) and hydrogen (H_2), produced by burning a solid fuel (biomass) with a deficiency of air or by passing a mixture of air and steam through a burning bed of solid fuel (biomass).

Pyrolysis: The breaking apart of complex molecules into simpler units by the use of heat. For this handbook, the process involves chemical decomposition of biomass to producer gas, fuel oil, and charcoal.

Qualifying facility: A nonutility operation that produces or cogenerates electric power for sale and meets certain state requirements.

Refuse-derived fuel: Fuel prepared from municipal solid waste by refining. Minimum refinement is usually removing noncombustible portions, such as rocks, glass, and metals, before chopping pieces into uniform sizes.

Renewable energy resource: Any energy resource that can be replaced after use through natural means. It includes solar energy, wind energy, hydropower, and energy from plant matter.

Solvent extraction: A method of separation in which a solid or solution is contacted with a liquid solvent (the two are mutually insoluble) to transfer one or more components into the solvent. This method is used to purify vegetable oils.

Stillage: The grains and/or liquid effluent remaining after distillation.

Total suspended particulates (TSP): Quantity of solid particles in a gas or exhaust stream.

Waste streams: Solid and/or liquid by-products of a biomass process that have no use or economic value.

Watt: The common base unit of power in the metric system equal to one joule per second, or to the power developed in a circuit by a current of one ampere flowing through a potential difference of one volt.

SECTION 1
WHERE TO START

INTRODUCTION

The *Montana Bioenergy Guidebook* was written to provide project developers, government officials, professionals, and the general public with a brief description of the technologies used in developing bioenergy projects and the permitting process involved with those projects. Many individuals, businesses, and municipalities are interested in developing bioenergy projects. Many laws and regulations affect such projects. There are applications to file, time deadlines to meet, requirements to comply with, and project information reports to file with the appropriate authorities. Because projects frequently require permits from local, state, and federal agencies, the guide is designed to cover all three levels of regulation. More detailed information on project development and technologies can be found in the *Biomass Energy Project Development Guidebook* by John Vranizan et al.

The purpose of the *Montana Bioenergy Guidebook* is to help people developing projects understand the permitting process. It is not a legal document and should not be relied on exclusively to determine legal responsibilities. It is not a substitute for obtaining detailed information regarding licenses, permits, standards, operating requirements, and enforcement from government agencies. Some permits and licenses not included in this guide may be necessary to a particular project. If a proposed project is at all related to specific areas of regulation listed, it is recommended that the appropriate agencies be contacted for further information.

HOW TO USE THE GUIDEBOOK

The *Montana Bioenergy Guidebook* is divided into five major sections. Section 1, Where to Start, explains the purposes of the guidebook and how to use it, introduces the user to bioenergy concepts, and outlines the process of planning a bioenergy project. Section 2, Bioenergy Technologies, discusses 10 bioenergy technologies and provides an overview of the permits, licenses, or other areas of compliance related to each technology. Also included are process flowcharts that detail feedstocks, process steps, end products, and potential emissions for each technology. Section 3, Environmental Considerations, discusses air quality, water quality, and waste management requirements. Section 4, Permits By Category, lists permits by topical area. Section 5, Special Considerations, covers items not mentioned elsewhere, including business licensing requirements, cogeneration, dam safety, and others. The appendices include lists of bioenergy projects, information on biomass resources, and lists of federal and state agencies and other organizations. An energy cost

comparison chart is inside the back cover. All books mentioned in the guidebook are cited in the bibliography. A glossary and a subject index are included. Finally, a list of abbreviations and acronyms is included inside the front cover.

Permit descriptions in Section 4 are based on interviews with each agency and information in the 1991 edition of the laws of Montana, the *Montana Code Annotated* (MCA), and in the state rules, the *Administrative Rules of Montana* (ARM), in force in June 1991. The MCA is available at most large public libraries and college and university libraries, while the ARM is available at the Montana State Library, the State Law Library of Montana, and most college and university libraries. Copies of specific rules are usually available from the agency that administers them.

Serious effort has been made to present accurate, comprehensive information in this guidebook. However, every project is unique, and the guidebook should be used only as a starting place in the permitting process. It is not a substitute for working closely with authorized agencies and other professionals for development of a project that is economically sound and in compliance with all federal and state laws and rules.

WHAT IS BIOMASS ENERGY?

For the purpose of this publication, biomass is any organic matter that is available on a renewable basis, including forest and mill residues, agricultural crops and wastes, wood and wood wastes, animal wastes, feedlot residues, food processing wastes, and municipal solid waste (MSW). All biomass contains carbon. Plants, trees, municipal waste, manure, and vegetable oils are all forms of biomass that can be used to produce energy. The energy obtained by processing biomass is called bioenergy. Bioenergy can produce electricity, mechanical power, space heat, or industrial process heat.

Bioenergy technologies such as alcohol fermentation, anaerobic digestion, direct combustion, densification, and cogeneration are being used in bioenergy projects in Montana. Montana projects include biogas use by sewage plants, fuel alcohol production from grains, use of wood waste for process heat or for conversion into fuel pellets, and burning municipal waste to produce process steam. Technologies that are used elsewhere and are being studied for their potential uses in Montana include oilseed extraction, use of landfill gas, liquefaction, pyrolysis, and gasification of various biomass residues.

A bioenergy facility may combine several technologies. For example, a boiler burning wood waste could provide process steam for an alcohol plant. Use of biomass to produce energy has numerous advantages including using local renewable resources, reducing energy costs, lowering the cost of transporting and disposing of waste, stimulating the local economy, and decreasing foreign trade deficits by reducing the use of imported oil and natural gas.

HOW TO PLAN A BIOENERGY PROJECT

Successful development of a bioenergy project depends on a number of factors, including thorough research and planning, economics, financing, resource availability, effective fuel collection and conversion, appropriate design for a general location, and efficient operation. Other considerations are how well project developers present the project to the government and the public, and choice of an appropriate design for a specific site. For more detailed information on planning a project, refer to the *Biomass Energy Project*

Development Guidebook by John Vranizan et al. The following guidelines, illustrated in Figure 1, are helpful for project planning.

1. Develop a Preliminary Project Plan

Develop an organized preliminary project plan that includes information on project goals, prospective sites, resource availability, plant size and design, technologies to be used, and market analyses for products. A preliminary financial and economic feasibility assessment should be developed to include estimates of project costs, projected revenues or savings, and economic factors that influence those areas. Prospective developers should research and assess possible environmental considerations and potential impacts.

2. Seek Preliminary Approval for the Project

Submit the preliminary project plan to the local authorizing agency such as a local planning board or county commissioners for preliminary review and approval. Local authorities will review the proposal to see if it complies with local land use regulations and ordinances. It also may be necessary to consult the local health office to see if regulations on air quality, sewage disposal, or waste disposal apply to the project.

3. Conduct a Detailed Study of the Proposed Project

A. Facility Design

Review the project goals, technologies to be used, and plant size and design to determine the technical feasibility of the project. An engineer can complete preliminary plant and system designs, develop technical options and alternative plans, and identify potential emissions, effluents, and environmental impacts.

B. Site Considerations

Select a preferred and an alternative site from the sites identified in the preliminary project plan. Considerations for site selection must include land costs, resource accessibility, market accessibility, transportation, environmental and cultural impacts, zoning restrictions, necessary permits, and utility availability. Coordination with local planning departments is required in the siting of the facility.

C. Economics

Review financial and economic factors such as resource costs and locations; potential markets and prices for end products; tax incentives; effects of fuel supply costs and fluctuations; if applicable, electricity buyback rates; and potential financing options. Conversion of a facility to use biomass fuel may produce a savings from lower fuel or disposal costs. Fuel costs can be compared quickly using the Montana Energy Cost Comparison Chart on the inside back cover. An accountant or business consultant can help prepare a business plan or loan prospectus.

4. Prepare a Detailed Project Plan

Develop a written plan that includes detailed information on cost, design, and site considerations. This project plan will provide information on the project to potential investors and other interested parties including local, state, and federal agencies involved in the permitting process. Apply for all permits necessary to the project by using this guidebook as a starting place to review laws and regulations related to a project. Because each project is unique, it is usually necessary to contact federal and state agencies to obtain more detailed information on permits and other areas of compliance. Develop a project timetable such as Figure 2, Permit Calendar. Identify other areas of compliance that may not require a permit, such as the bond an ethanol plant must have if it is to handle grain

FIGURE 1

HOW TO PLAN A BIOENERGY PROJECT

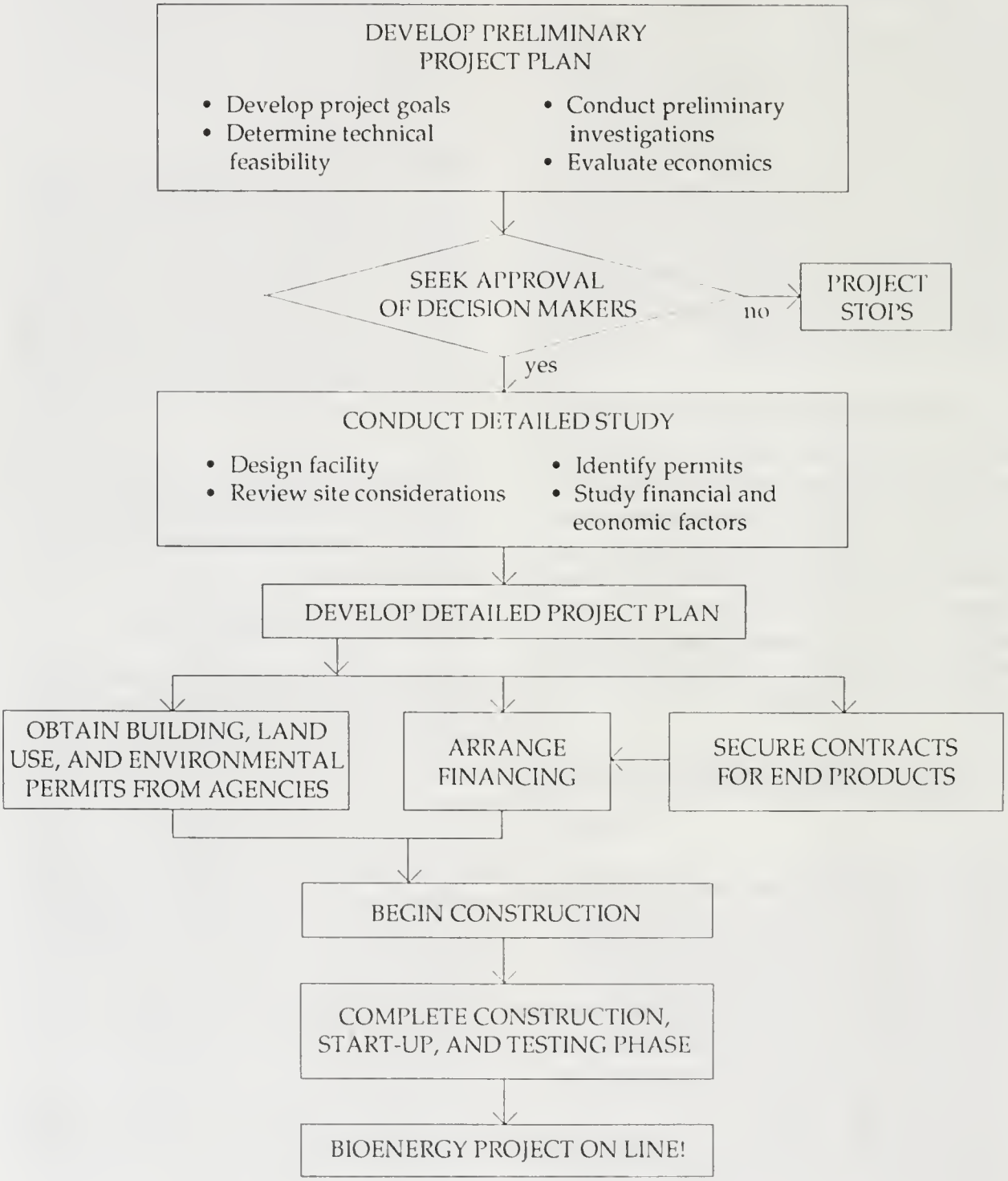
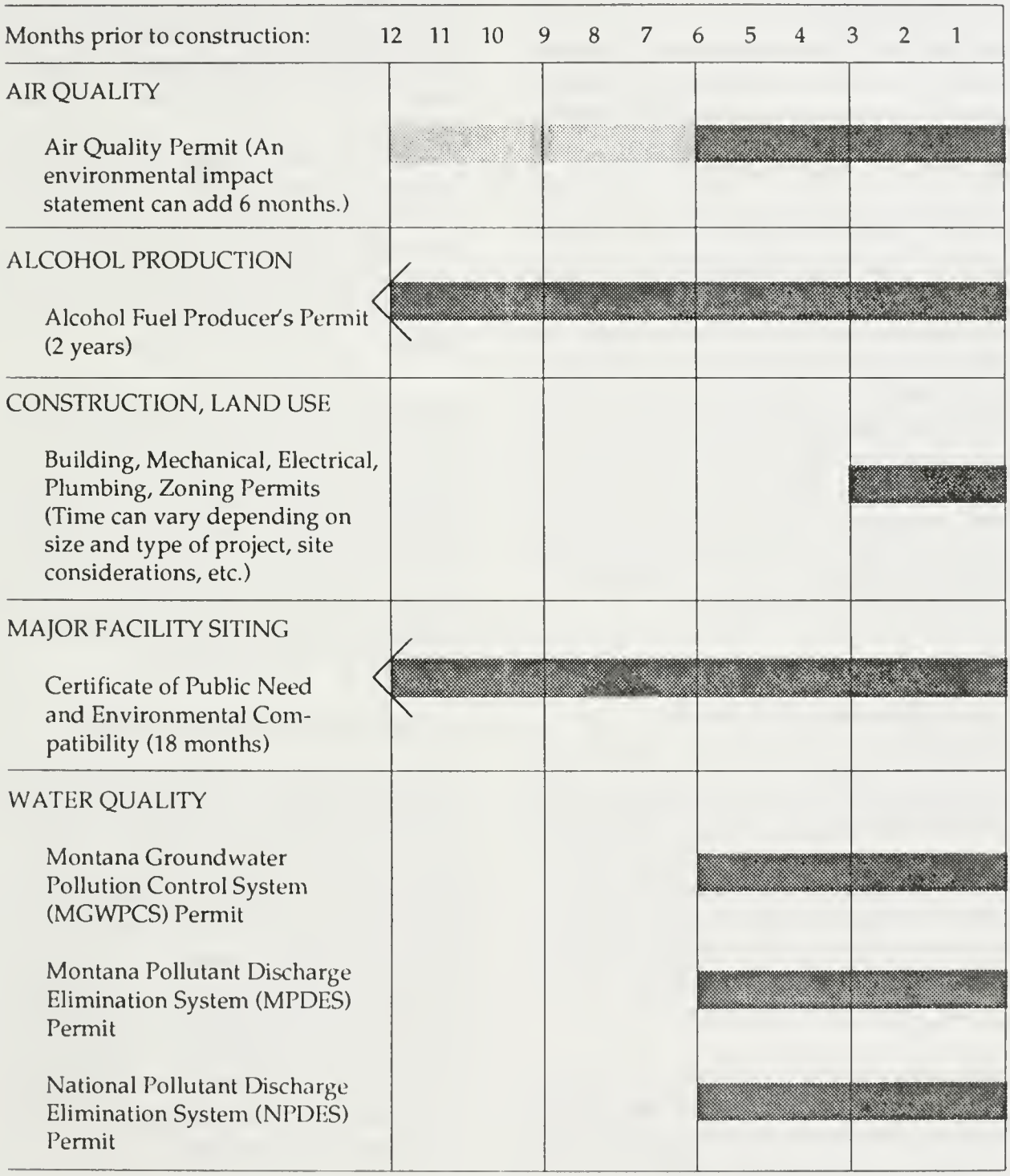


FIGURE 2

PERMIT CALENDAR

Minimum time you can expect before approval of a project. (Most facilities do not require all these permits.)



(See Commodity Dealer's License, page 52). Identify areas of business regulation such as company registration, licenses, taxes, and employment information that require compliance.

5. Arrange Financing

Review the economic section of the detailed study to determine the project's best selling points. Contact financial institutions with the business plan and loan prospectus. Assistance may be available from the Montana Science and Technology Alliance, which has some loan money available for Montana business ventures and is establishing a Montana venture capital network. For more information, contact DOC. Assistance also may be available through the Montana Growth Through Agriculture Program, which can fund a variety of agriculture-related activities. Eligible activities include foreign and domestic market development, agricultural technology research and transfer, and seed capital awards for development and commercialization of new products and processes. For more information, contact DOA, Agriculture Development Division.

6. Obtain Permits For Building, Land Use, and Environmental Controls

Contact the appropriate city or county agency for land use permits. Permit titles, forms, and procedures differ, but local governments must approve project plans before construction can begin. Site approval for a large energy project can be a long, complicated process. It can include site surveys, public hearings, and litigation. Land use permits are required before environmental permits can be issued.

Construction plans and building operations must be approved by either the state or local building office, depending on jurisdiction in the plant area. The authorizing agency may have to inspect buildings and equipment before operation begins.

Environmental permits are generally required for air and water discharges or waste disposal. Some air and water permits may require site monitoring for data before a permit can be issued. Finally, monitoring of the site may be required at intervals after the project is initiated.

The total time needed to obtain required project permits may vary from a few months for a small project to over a year for a larger one, as illustrated in Figure 2. Factors that influence the time involved include delays in the land use approval process and compliance with environmental monitoring requirements.

Once all permits are obtained, construction can begin. Be aware that additional permits may be required during construction for specific tasks such as a permit for open burning during site clearing, a grading permit, a permit to operate overweight vehicles on roads, a sewage holding tank variance, and others. Coordination with the appropriate federal, state, and local agencies will alleviate unexpected delays.

7. Secure Contracts for End Products

Contact potential buyers of bioenergy products such as electric utilities, gas utilities, pellet or wood fuel distributors, and refineries. A contingency contract with a buyer will greatly increase chances for obtaining financing. In the absence of a contract, a letter expressing interest from a reputable buyer would be of value. Once the required permits are obtained, financing is secured, and construction has begun, contract negotiations for supplies and sales should be finalized. The time of product delivery should be the only item left for possible negotiation by the buyer when construction begins.

8. Complete Construction and Start-Up/ Testing

Completing construction requires attention to detail. Final checklists identifying modifications to the design plans made during construction should be reviewed with the construction engineer and contractor. This on-site review is to ensure that all items noted during construction have been checked and corrected. If the construction is a "turnkey" project, then the engineer from the turnkey company will be responsible for the integrity of the construction.

During start-up and testing, environmental monitoring is usually required. Requirements may include close monitoring of stack emissions and special treatment of wastes. The time to optimize the actual operation of the facility is during testing.

SECTION 2
BIOENERGY TECHNOLOGIES

INTRODUCTION

Bioenergy technologies are in various phases of development throughout the world. Both economic viability and technical development must be considered when evaluating a bioenergy technology for commercial use.

Selected information on Montana projects using these technologies is in Appendix A and detailed in the DNRC publication, *Directory of Montana Biomass Energy Facilities* (Haines 1988), soon to be updated as *Montana Bioenergy Facilities*. Information on bioenergy projects outside Montana may be reviewed in *Bionote: An Inventory of Industrial and Commercial Boilers Burning Wood or Related Biomass Fuels in Alaska* (Woodell 1986), *Biomass Energy Facilities—1988 Directory of the Great Lakes Region* (Great Lakes Regional Biomass Energy Program 1988), *Idaho Directory of Biomass Energy Facilities* (Peppersack and Galinato 1987), *Directory of Oregon Biomass Energy Facilities* (Sifford 1987), and the *Washington Directory of Biomass Energy Facilities* (Kerstetter 1987).

Table 1 describes the 10 technologies that are introduced in this section, listing the process, major biomass resources, and energy products for each technology. Some of the technologies are used in Montana, while others are in the developing stages. Table 2 identifies agencies that serve as information sources for each technology. Addresses for all agencies listed can be found in Appendix B.

Figures 3 through 12 are process flowcharts for each of these 10 technologies and are generic in nature to cover many possible configurations of a bioenergy facility. Each process flowchart lists feedstocks, process steps, and potential environmental emissions. The text that accompanies each flowchart gives an overview of the permits, licenses, or other areas of compliance or regulations that apply to that technology.

TABLE 1

BIOENERGY TECHNOLOGIES

TECHNOLOGY	MAJOR BIOMASS RESOURCES	ENERGY PRODUCTS
Alcohol fermentation	Grains, starch, cellulose, food processing waste, forest and agricultural residue	Ethanol, butanol
Anaerobic digestion	Manure (poultry, dairy cows, pigs), cellulose, food processing waste, wastewater (sewage), garbage	Biogas, methane
Cogeneration	Wood, densified biomass, agricultural residue, garbage, biogas	Heat, steam, electricity, mechanical power
Densification	Forest and agricultural residue, sawmill wastes, garbage	Pellets, briquettes, densified logs, cubes
Direct combustion (suspension burners, fluidized bed combustors, boilers, furnaces)	Wood, straw, densified biomass, garbage, agricultural residue, sawmill waste	Heat, steam, electricity (cogeneration)
Gasification	Forest and agricultural residue, garbage	Methane, producer gas, methanol
Landfill gas	Garbage	Methane, biogas
Liquefaction	Forest and agricultural residue, garbage, sawmill waste	Hydrocarbons (oil)
Oilseed extraction	Agricultural crops (sunflowers, safflowers, canola)	Diesel fuel substitute, replacement for petroleum-derived oils
Pyrolysis	Forest and agricultural residue, sawmill waste, garbage	Producer gas, fuel oil, hydrocarbons, char

TABLE 2

INFORMATION SOURCES FOR BIOENERGY TECHNOLOGIES

	MASS	DOA	DHES, WQB	DHES, SHWB	DNRC, ED	DSL	BLM	USFS
Alcohol fermentation	•	•	•	•	•	•	•	•
Anaerobic digestion	•	•	•	•	•			
Cogeneration			•	•	•	•	•	•
Densification			•	•	•	•	•	•
Direct combustion			•	•	•	•	•	•
Gasification			•	•	•	•	•	•
Landfill gas			•	•	•			
Liquefaction			•	•	•	•	•	•
Oilseed extraction	•	•	•	•	•			
Pyrolysis			•	•	•	•	•	•

MASS — Montana Agricultural Statistics Service

DOA — Montana Department of Agriculture

DHES, WQB — Montana Department of Health and Environmental Sciences, Water Quality Bureau

DHES, SHWB — Montana Department of Health and Environmental Sciences, Solid and Hazardous Waste Bureau

DNRC, ED — Montana Department of Natural Resources and Conservation, Energy Division

DSL — Montana Department of State Lands

BLM — U.S. Department of the Interior, Bureau of Land Management

USFS — U.S. Department of Agriculture, Forest Service

ALCOHOL FERMENTATION

Feedstocks such as wheat, barley, potatoes, waste paper, sawdust, and straw contain sugar, starch, or cellulose and can be converted to alcohol by fermentation with yeast. Fuel alcohol is produced by boiling grain starch to sugar, adding yeast, fermenting the sugar to alcohol, and then separating the alcohol mixture by distillation, as illustrated in Figure 3. Feedstocks used in Montana are barley and wheat. Agricultural and forest residues, such as straw and wood, contain cellulose and require special pretreatment and processing to convert the cellulose to sugar. Conversion of cellulose feedstocks to ethanol is a developing technology. Pilot scale plants operate in New York and Utah.

Montana's only operating fuel ethanol plant is in Ringling. Detailed information on other ethanol projects is in the DNRC publication, *Montana Bioenergy Facilities* (forthcoming). Selected information on Montana bioenergy projects is in Appendix A.

Most of the permits, licenses, and special issues pertaining to the operation of fuel ethanol plants in Montana are summarized in Table 3.

Environmental Permits

Alcohol plants, illustrated in Figure 3, have waste streams with high biological oxygen demand (BOD), high chemical oxygen demand (COD), high solids content, and varying pH. If no use is found for this "stillage," it can create a large waste disposal problem. Acid hydrolysis of cellulose creates waste streams that require sophisticated neutralization processes. Water pollution permits will be required to discharge any of these waste streams or possibly to pond or hold these wastes on site. (See Water Quality, pages 50 and 65.)

Air quality permits are required for discharge of exhaust gases from the boiler and the grain dryer depending on the size of the burner and the type of fuel. Special consideration may have to be given to odor control. (See Air Quality, pages 39 and 54.) If an alcohol plant burns solid fuel, it may need to comply with PM-10 ambient air quality standards established by EPA. These standards are for particulate matter with an aerodynamic diameter of 10 microns or less. (See Air Quality, pages 44 and 46.)

Solid and hazardous waste regulations are becoming more stringent, and cleanup costs may be imposed if improper disposal occurs. Waste generators are legally liable for proper disposal of waste. Solid waste disposal permits are not required if wastes, such as unmarketable distillers' grains, are disposed of at licensed facilities. If the waste is classified as a hazardous waste, there are detailed reporting requirements for disposal. Any facility storing solid waste, such as hog fuel or refuse-derived fuel, may require a solid waste management system license. For a definition of solid waste and information on the law, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

Local permits are required for different phases of planning and construction. Fire and explosion safety are considerations at alcohol plants and may even affect insurance coverage. Alcohol is classified as a class 1B flammable liquid the same as gasoline, and presents a fire and explosion hazard. Grain handling and milling present dust explosion hazards. Explosion-proof equipment and wiring are needed in areas where alcohol is handled and grain dust is present.

FIGURE 3

ALCOHOL FERMENTATION

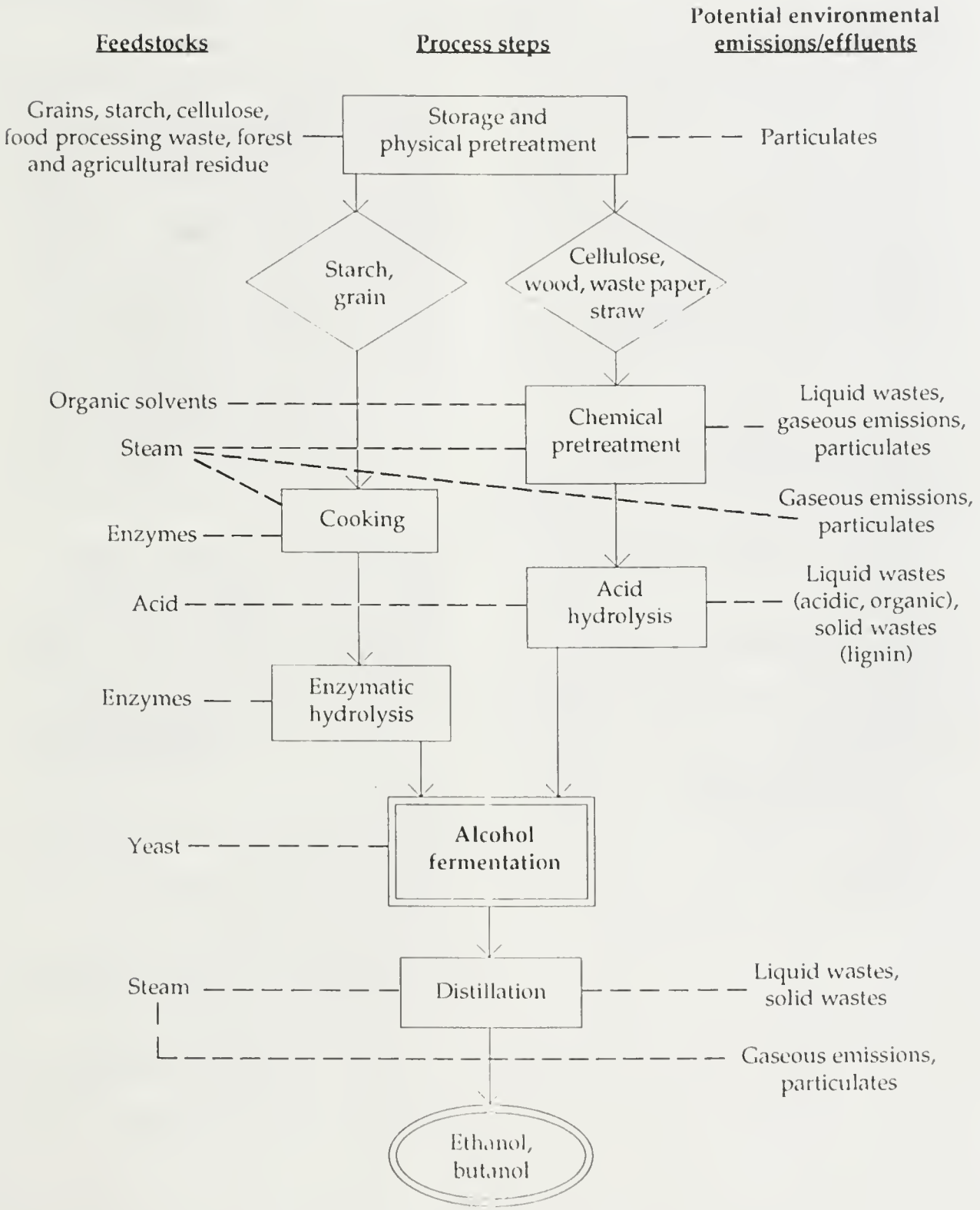


TABLE 3

ALCOHOL FERMENTATION PERMITS, LICENSES, AND SPECIAL ISSUES

Alcohol Production

- Alcohol Distributor's License (DOR)
- Alcohol Fuel Producer's Permit (BATF)
- Gasoline License Tax on Gasohol Sold in Montana (DOR)
- Real and Personal Property Tax Reduction for Property Used in the Production of Alcohol (DOR)
- Special Occupations Tax (BATF)
- Tax Incentive on Alcohol Blended with Gasoline for Sale as Gasohol (DOR)

Construction and Land Use

- Boiler Operating Certificate (DOLI)
- Boiler Operator's License (DOLI)
- Building Permit (DOC or local building department)
- Electrical Permit (DOC or local building department)
- Floodplain Development Permit (DNRC)
- Lakeshore Development Permit (local government)
- Mechanical Permit (DOC or local building department)
- Occupational Safety and Health Administration Standards (OSHA)
- Odor Control (DHES)
- Plumbing Permit (DOC or local building department)

Environmental Considerations

- Air Quality Construction and/or Operating Permit (DHES)
- Beneficial Water Use Permit (DNRC)
- Hazardous Waste Management Facility Permit (DHES)
- Hazardous Waste Reporting Requirements (DHES)
- Montana Groundwater Pollution Control System (MGWPCS) Permit (DHES)
- Montana Pollutant Discharge Elimination System (MPDES) Permit (DHES)
- National Pollutant Discharge Elimination System (NPDES) Permit (DHES)
- Nonattainment Permitting Requirements (DHES)
- Odor Control (DHES)
- PM-10 Air Quality Standards (DHES)
- Prevention of Significant Deterioration (PSD) Review (DHES)
- Solid Waste Management System License (DHES)
- Stream Protection Act Permit (DFWP)
- Streambed and Land Preservation Permit (310 Permit) (normally, local conservation district)

Special Concerns

- Business Licensing Requirements (DOC and local government)
- Commodity Dealer's License (DOA)
- Electrical Energy Producer's License (DOR)
- Feed Dealer's Permit (DOA)
- Fire Safety Inspections (DOJ, state fire marshall, municipal fire chief, or county sheriff)
- Warehouseman's License (DOA)

Boilers and boiler operators must be licensed by the Department of Labor and Industry (DOLI), Safety Bureau. (See Occupational Safety and Health, pages 62 and 75.)

Special Issues

Alcohol producers must properly qualify the alcohol plant and obtain a permit from the U.S. Bureau of Alcohol, Tobacco, and Firearms (BATF). Bonding requirements vary depending on the size of the plant. BATF has detailed reporting requirements. Application forms and an information packet are available from the San Francisco office of BATF. (See Appendix B, Agencies/Organizations.) Since January 1, 1988, anyone engaged in an alcohol activity who holds a BATF permit or license may be required to pay a special occupations tax. The San Francisco office of BATF can supply information and forms related to this tax.

A Feed Dealer's Permit from DOA, Plant Industry Division is required for distillers' dried grains (DDGS) or other coproducts that are distributed as commercial feed in Montana. The commercial feed must be registered and comply with labeling format and other requirements as stated in DOA rules.

Additionally, anyone marketing or housing grain may have to obtain an agricultural commodity dealer's license or a warehouseman's license. (See Agriculture, page 52.)

Prior to doing business in Montana, every fuel alcohol distributor must obtain a license from the state DOT, Motor Fuels Tax Division, Accounting Services Bureau, Gasoline Unit. DOT requires alcohol distributors to file detailed monthly statements on all sales activities. This information qualifies a distributor for a tax incentive on each gallon of alcohol sold, provided the alcohol was produced in Montana from Montana agricultural products, including wood or wood products, and that the alcohol was blended with gasoline for sale as gasohol or was exported from Montana and blended with gasoline for sale as gasohol.

Gasoline distributors who blend alcohol with gasoline and distribute it in Montana are required to pay a gasoline license tax on each gallon of gasohol sold in Montana. If the gasohol is exported, no tax is required.

Real and personal property used in gasohol or fuel ethanol production facilities in Montana may be eligible for property tax reductions for the first three years of use. For more information on this, contact the Agricultural Bureau Chief of DOR, Property Assessment Division.

ANAEROBIC DIGESTION

Anaerobic digestion converts organic matter to a mixture of methane, the major component of natural gas, and carbon dioxide (CO_2). Biomass, such as manure, straw, sewage, or food processing wastes, is mixed with water and fed into a digester tank without air. There microbes and bacteria break the biomass down to biogas, liquid effluent, and sludge, as shown in Figure 4. The methane content of biogas can be as high as 80 percent if the reactor is designed for energy output. At present, the digestion process is used primarily to process animal manure and municipal sewage, but also can be used to process most cellulose materials. The methane produced can be used for heating, process heat, mechanical energy, or electrical generation.

Billings, Bozeman, Helena, Kalispell, and Missoula use the biogas they produce from sewage treatment operations. The biogas is used to fire boilers or fuel-modified diesel engine generators. Plants at Billings and Helena use the cooling water warmed by the biogas-fired diesel engine to heat digesters or to preheat boiler feed water. The biogas can also be used directly to fuel the boilers if the methane content is greater than 50 percent.

Montana's only on-farm anaerobic digester is located in Conrad. Low electricity prices coupled with other factors have delayed start-up of the Conrad digester. A small digester at a Missoula dairy was destroyed in a fire in June 1988.

Detailed information on bioenergy projects is contained in the DNRC publication, *Montana Bioenergy Facilities* (forthcoming). Selected information on Montana bioenergy projects is included in Appendix A.

Most of the permits, licenses, and special issues for anaerobic digesters in Montana are summarized in Table 4.

Environmental Permits

The main environmental concern with anaerobic digesters is that digested sludge and wastewater cannot be discharged into state waters. For example, an animal confinement facility is a point source of pollution and may require a Montana Pollutant Discharge Elimination System (MPDES) Permit. (See Water Quality, pages 50 and 65.)

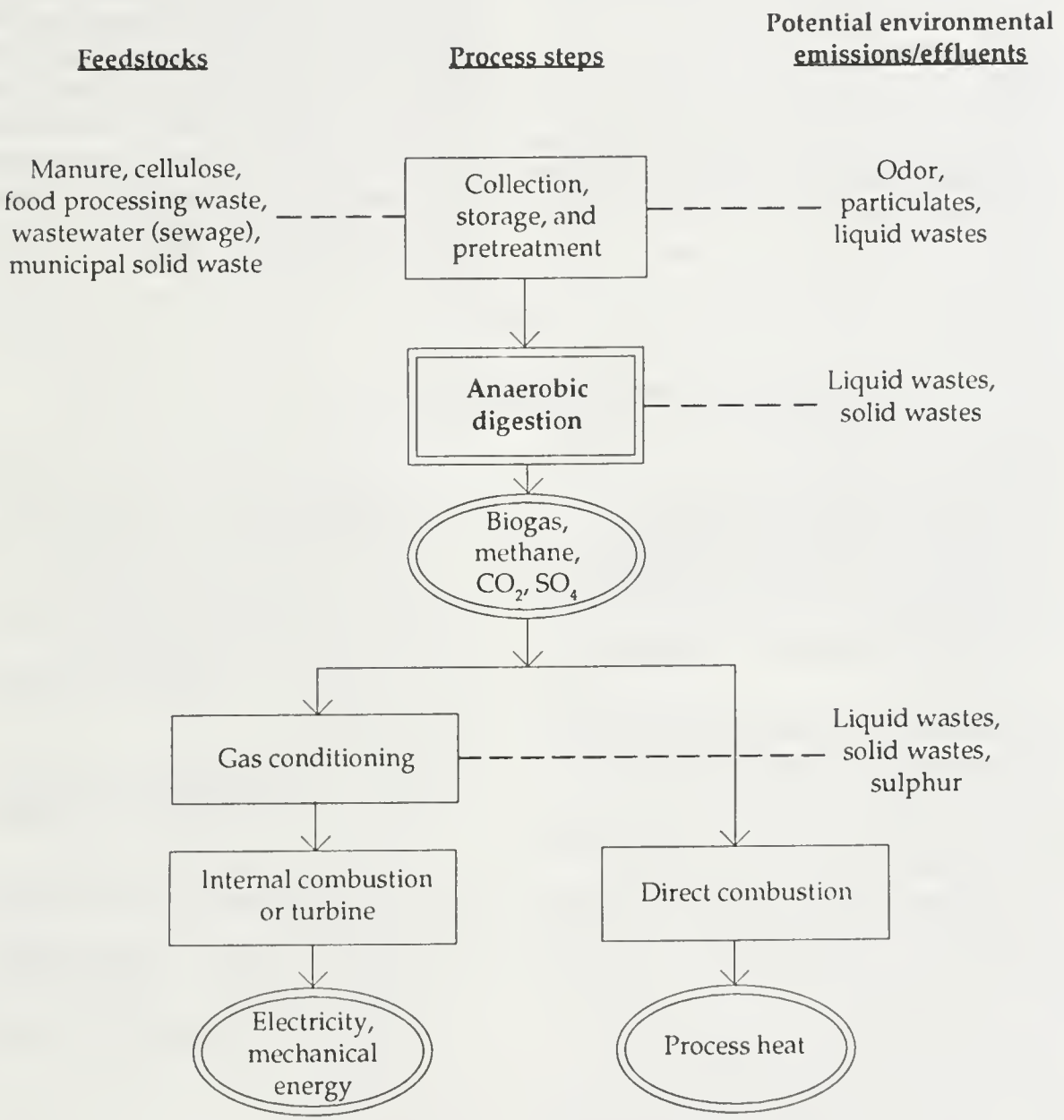
DHES is responsible for enforcement of odor control rules. Any business or person using any device, facility, or process that discharges odorous matter, vapors, gases, dusts, or combination of these that creates odors is subject to regulation. That person must provide, properly install, maintain, and operate odor control devices or procedures as specified by DHES.

If a facility discharges particulates from raw materials, it may need to comply with PM-10 ambient air quality standards established by EPA. These standards are for particulate matter with an aerodynamic diameter of 10 microns or less. (See Air Quality, pages 44 and 46.)

Solid and hazardous waste regulations are becoming more stringent, and cleanup costs may be imposed if improper disposal occurs. Waste generators are legally liable for proper disposal of waste. Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. If the waste is classified as hazardous, there are detailed reporting requirements for disposal. Any facility storing solid waste, such as hog fuel or refuse-derived fuel, may require a solid waste management system license. For a

FIGURE 4

ANAEROBIC DIGESTION



definition of solid waste and information on the law, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

The biogas digester and biogas-handling equipment must comply with all mechanical, electrical, and building codes. (See Building, Mechanical, Electrical, and Plumbing Permits, page 57.)

Special Issues

Anaerobic digestion projects that produce electricity may be required to pay an electrical energy producer's license tax. Montana law states that each person or organization engaged in the generation, manufacture, or production of electricity and electrical energy for barter, sale, or exchange must pay an electrical energy producer's tax of $.0002 per kilowatt-hour. For information contact DOR, Natural Resource and Corporation Tax Division.

TABLE 4

ANAEROBIC DIGESTION PERMITS, LICENSES, AND SPECIAL ISSUES

Construction and Land Use

- Boiler Operating Certificate (DOLI)
- Boiler Operator's License (DOLI)
- Building Permit (DOC or local building department)
- Electrical Permit (DOC or local building department)
- Floodplain Development Permit (DNRC)
- Lakeshore Development Permit (local government)
- Mechanical Permit (DOC or local building department)
- Occupational Safety and Health Administration Standards (OSHA)
- Plumbing Permit (DOC or local building department)

Environmental Considerations

- Air Quality Construction and/or Operating Permit (DHES)
- Beneficial Water Use Permit (DNRC)
- Hazardous Waste Management Facility Permit (DHES)
- Hazardous Waste Reporting Requirements (DHES)
- Montana Groundwater Pollution Control System (MGWPCS) Permit (DHES)
- Montana Pollutant Discharge Elimination System (MPDES) Permit (DHES)
- National Pollutant Discharge Elimination System (NPDES) Permit (DHES)
- Nonattainment Permitting Requirements (DHES)
- Odor Control (DHES)
- PM-10 Air Quality Standards (DHES)
- Prevention of Significant Deterioration (PSD) Review (DHES)
- Solid Waste Management System License (DHES)
- Stream Protection Act Permit (DFWP)
- Streambed and Land Preservation Permit (310 Permit) (normally, local conservation district)

Special Concerns

- Business Licensing Requirements (DOC and local government)
- Electrical Energy Producer's License (DOR)
- Fire Safety Inspections (DOJ, state fire marshall, municipal fire chief, or county sheriff)

COGENERATION

Cogeneration is the simultaneous production of more than one form of energy using a single fuel and facility as shown in Figure 5. Furnaces, boilers, or engines fueled with biomass can cogenerate electricity for on-site use or sale. Biomass cogeneration has more potential growth than biomass generation alone because cogeneration produces both heat and electricity. Electric power generators can become cogenerators by using the heat from electric generation for process heat. Increased fuel efficiency and savings in fuel and energy costs are the major incentives for considering cogeneration.

Montana's wood products industry uses cogeneration to dispose of bark and sawdust produced in its lumber and paper operations. Half of the industrial wood waste in Montana is used at wood products plants in Libby and Frenchtown. These operations burn wood waste to generate steam that powers a turbine generator to reduce its pressure for use as process heat. Electricity generated is used on-site. These power plants produce approximately 138.6 million kilowatt-hours annually from a total of 18.5 megawatts of wood-fired generation capacity.

Most of the permits, licenses, and special issues pertaining to biomass cogeneration in Montana are listed in Table 5 and in Special Considerations: Cogeneration and Small Power Production, page 71.

Environmental Permits

Biomass-fired furnaces and boilers must meet state air quality regulations. A permit is required from the DHES Air Quality Bureau for furnaces and boilers that have a heat input of 10,000,000 Btus per hour if they are burning liquid or gaseous fuels, or 5,000,000 Btus per hour if they are burning solid fuel. The rule concerning particulate emissions from new fuel-burning installations, shown in Figure 13, may be applied, but BACT standards are applicable to bioenergy projects. BACT may be more stringent than values shown in Figure 13, so all point sources must use BACT to be sure of meeting particulate emission requirements. (See Air Quality, page 41.)

Prevention of Significant Deterioration (PSD) standards and National Ambient Air Quality Standards (NAAQS) apply to major new sources of air pollution. (See Air Quality, pages 41, 43, and 55.) If a facility burns solid fuel, it may be required to comply with EPA's PM-10 ambient air quality standards. These standards are for particulate matter with a diameter of 10 microns or less. (See Air Quality, pages 44 and 46.) If a facility produces more than 25 megawatts and sells more than one-third of its power to a utility, it may be required to comply with Title IV acid rain provisions of the Clean Air Act. Some municipalities have adopted their own air pollution control programs. (See Urban Areas/ Municipalities, page 76.) Odor control is a special consideration. (See Air Quality, pages 40 and 42.)

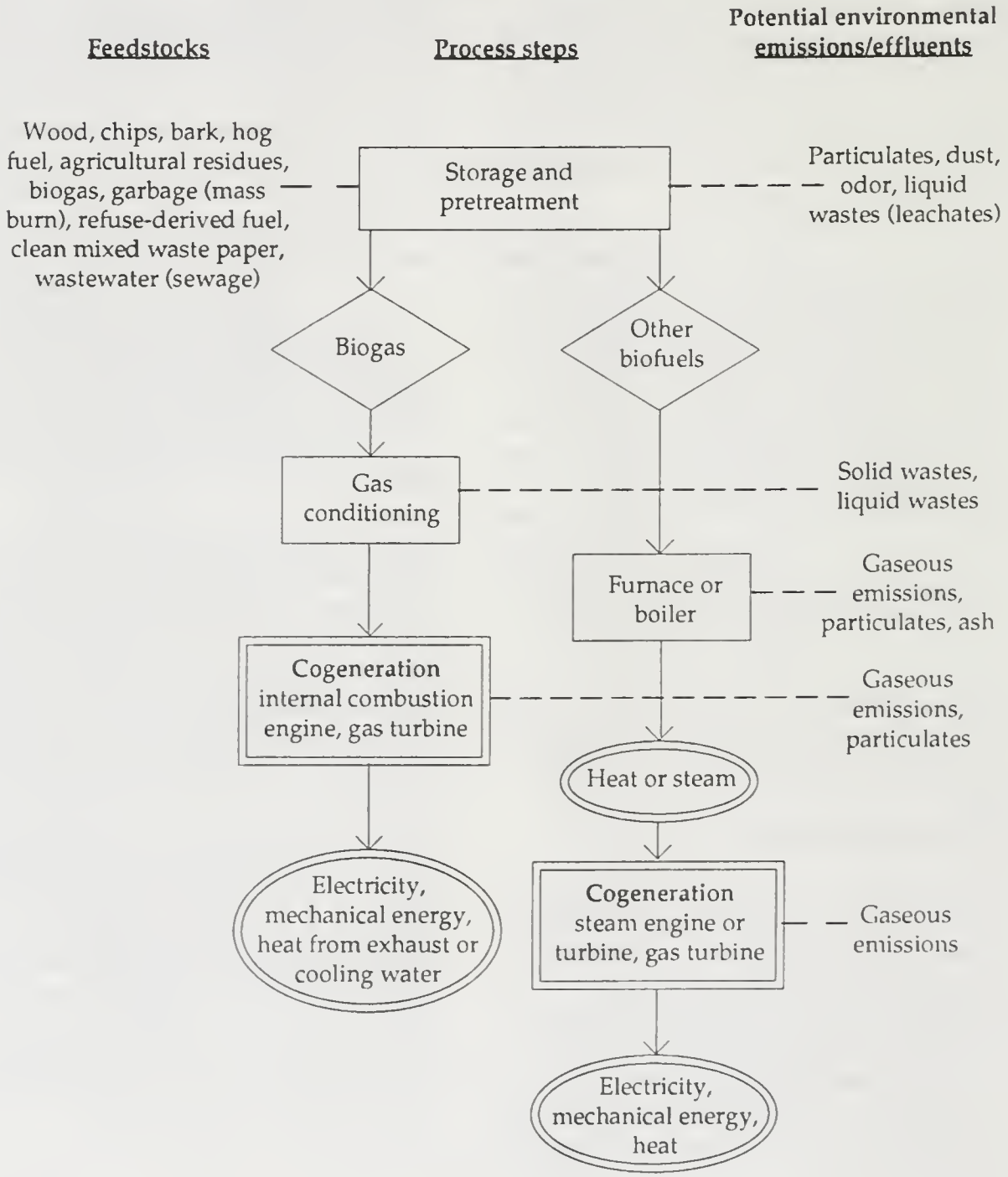
Solid and hazardous waste regulations are becoming more stringent, and cleanup costs may be imposed for improper disposal. Waste generators are legally liable for the proper disposal of waste. Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. If the waste is classified as hazardous, there are detailed reporting requirements for disposal. Any facility storing solid waste, such as wood waste or refuse-derived fuel, may require a solid waste management system license. Discharges of pollutants into state waters from a point source may require an MGWPCS Permit. (See Waste Management, pages 47 and 63 and Water Quality, pages 50 and 65.) For a definition of solid waste and information on the law, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

For projects proposed for urban areas, the local planning office must be consulted to determine zoning requirements and the land use permits that will be needed. (See Urban Areas/Municipalities, page 76.) Boilers and boiler operators must be licensed by DOLI's Safety Bureau. (See Occupational Safety and Health, pages 62 and 75.)

FIGURE 5

COGENERATION


Feedstocks
Process steps
Potential environmental emissions/effluents
Wood, chips, bark, hog fuel, agricultural residues, biogas, garbage (mass burn), refuse-derived fuel, clean mixed waste paper, wastewater (sewage)
Storage and pretreatment
Particulates, dust, odor, liquid wastes (leachates)
Biogas
Other biofuels
Gas conditioning
Solid wastes, liquid wastes
Furnace or boiler
Gaseous emissions, particulates, ash
Cogeneration internal combustion engine, gas turbine
Gaseous emissions, particulates
Heat or steam
Electricity, mechanical energy, heat from exhaust or cooling water
Cogeneration steam engine or turbine, gas turbine
Gaseous emissions
Electricity, mechanical energy, heat

Special Issues

Before a cogeneration facility can sell electric power in Montana, it must be certified by the Federal Energy Regulatory Commission (FERC) as a qualifying facility (QF). The Montana Public Service Commission (PSC) sets rates for sales by cogenerators to public utilities, but not for sales to electric cooperatives. (See Cogeneration and Small Power Production, page 71.)

If the plant produces more than 50 megawatts, DNRC requires a certificate of public need and environmental compatibility. (See Major Facility Siting, page 61.)

Montana law specifies that each person or organization engaged in the generation, manufacture, or production of electricity and electric energy for barter, sale, or exchange must pay an electrical energy producer's tax of $.0002 per kilowatt-hour. For information, contact DOR, Natural Resource and Corporation Tax Division.

TABLE 5

COGENERATION PERMITS, LICENSES, AND SPECIAL ISSUES

Construction and Land Use

- Boiler Operating Certificate (DOLI)
- Boiler Operator's License (DOLI)
- Building Permit (DOC or local building department)
- Electrical Permit (DOC or local building department)
- Floodplain Development Permit (DNRC)
- Lakeshore Development Permit (local government)
- Mechanical Permit (DOC or local building department)
- Occupational Safety and Health Administration Standards (OSHA)
- Plumbing Permit (DOC or local building department)

Environmental Considerations

- Air Quality Construction and/or Operating Permit (DHES)
- Beneficial Water Use Permit (DNRC)
- Hazardous Waste Management Facility Permit (DHES)
- Hazardous Waste Reporting Requirements (DHES)
- Montana Groundwater Pollution Control System (MGWPCS) Permit (DHES)
- Montana Pollutant Discharge Elimination System (MPDES) Permit (DHES)
- National Pollutant Discharge Elimination System (NPDES) Permit (DHES)
- Nonattainment Permitting Requirements (DHES)
- Odor Control (DHES)
- PM-10 Air Quality Standards (DHES)
- Prevention of Significant Deterioration (PSD) Review (DHES)
- Solid Waste Management System License (DHES)
- Stream Protection Act Permit (DFWP)
- Streambed and Land Preservation Permit (310 Permit) (normally, local conservation district)

Special Concerns

- Business Licensing Requirements (DOC and local government)
- Certificate of Public Need and Environmental Compatibility (DNRC)
- Electrical Energy Producer's License (DOR)
- Fire Safety Inspections (DOJ, state fire marshall, municipal fire chief, or county sheriff)

DENSIFICATION

Dried compressed pellets, briquettes, densified logs, and cubes are called densified biomass fuels and can be made from wood wastes, agricultural residue, waste paper, trash, or refuse-derived fuel, as illustrated in Figure 6. Densification is a fuel-processing technology used to reduce the volume of raw biomass to make it easier to use or transport. This process reduces biomass to particles less than 1/4 inch that have been dried to 10 to 15 percent moisture content, and then compresses or extrudes the material to between one-quarter and one-third of the original volume of the feedstock. The heat and pressure from the compression or extrusion soften the lignin bonds in the biomass to reform and maintain the densified shape. The moisture in the feedstock becomes steam and acts as a lubricant in the compression die to release the densified biomass. Some processes use additional binders or lubricants. Different machines produce various sizes of densified biomass ranging from pea-sized pellets to logs 6 inches in diameter and 12 inches long. The densified biomass can be used in home-heating wood stoves, furnaces, and fireplaces, or in industrial furnaces and boilers for process heat, steam, or electric generation.

Only sawmill residues have been pelleted in Montana to date. Annual production of pellet mills in Montana was approximately 8,000 tons in 1989.

Residential use of wood pellets has grown due to the high quality and low price of pellets from the six Montana pellet mills. Air quality restrictions on residential stick-wood burners further contribute to the use of wood pellets because pellet stoves are clean burning and do not violate air quality regulations.

Selected information on Montana bioenergy projects is included in Appendix A. Detailed information on bioenergy projects is in the DNRC publication, *Montana Bioenergy Facilities* (forthcoming).

Most of the permits, licenses, and special issues pertaining to biomass densification in Montana are listed in Table 6.

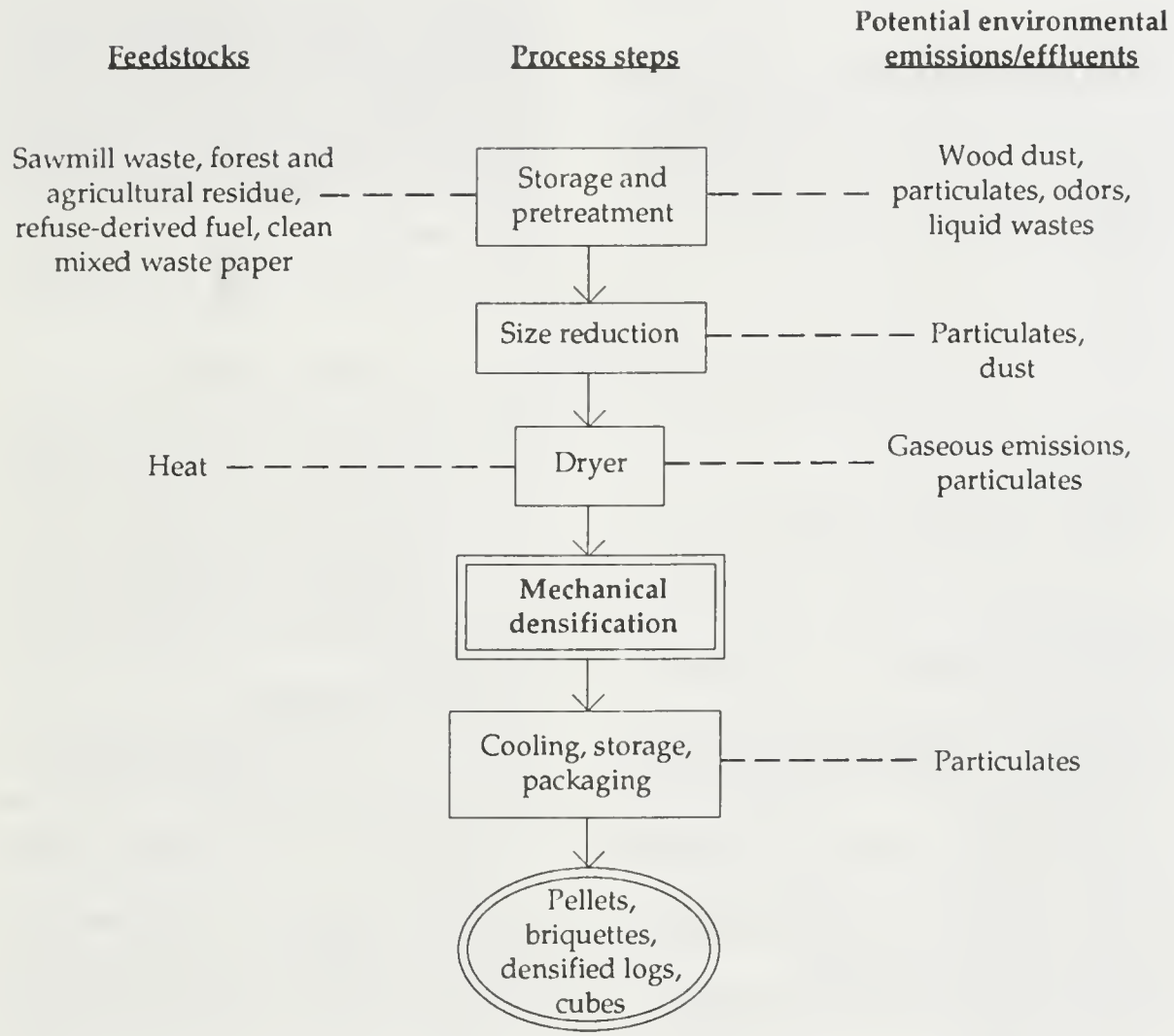
Environmental Permits

Pellet plants and other biomass-processing plants have the potential to emit air pollutants during the drying process. The location of a facility and type of combustion source and equipment will determine the permit requirements. If a facility burns solid fuel, it may have to comply with PM-10 ambient air quality standards established by EPA. These standards are for particulate matter with an aerodynamic diameter of 10 microns or less. (See Air Quality, pages 44 and 46.) Some municipalities have also adopted their own air pollution control programs. (See Urban Areas/Municipalities, page 76.) Special consideration may need to be given to odor control (See Air Quality, pages 40 and 42.)

Solid and hazardous waste regulations are becoming a greater consideration, and improper disposal may result in unforeseen costs. Waste generators are legally liable for the proper disposal of waste. Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. If the waste is classified as hazardous, there are detailed reporting requirements for disposal. Any facility storing solid waste, such as hog fuel, wood waste, or refuse-derived fuel, may require a solid waste management system license. Discharges of pollutants into state waters from a point source are regulated by the Montana Water Quality Act and require an MGWPCS Permit (See Waste Management,

FIGURE 6

DENSIFICATION



pages 47 and 63 and Water Quality, pages 50 and 65.) For a definition of solid and hazardous waste and information on the law, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

Densification facilities or pellet plants are usually located in industrial areas or near sources of forest and agricultural residue. Local building and planning agencies should be consulted before any construction begins. These facilities are required to comply with all building, mechanical, and electrical codes. (See Building, Mechanical, Electrical, and Plumbing Permits, page 57.)

Special Issues

Timber and slash removal permits are required from the appropriate state or federal agency for

commercial harvesting of trees or forest residue from state or federal lands. (See Forest Clearing and Burning, page 59 and Forested Areas, page 73.)

Wood pellets are considered a manufactured wood product. If pellets are to be transported intra-state, the hauling must be done by the pellet producer or by a carrier approved by the Interstate Commerce Commission (ICC).

Pellet manufacturing plants that produce electricity may be required to pay an electrical energy producer's license tax. Montana law states that each person or organization engaged in the generation, manufacture, or production of electricity for barter, sale, or exchange must pay an electrical energy producer's tax of $.0002 per kilowatt-hour. For information, contact DOR, Natural Resource and Corporation Tax Division.

TABLE 6

DENSIFICATION PERMITS, LICENSES, AND SPECIAL ISSUES

Construction and Land Use

- Boiler Operating Certificate (DOLI)
- Boiler Operator's License (DOLI)
- Building Permit (DOC or local building department)
- Electrical Permit (DOC or local building department)
- Floodplain Development Permit (DNRC)
- Lakeshore Development Permit (local government)
- Mechanical Permit (DOC or local building department)
- Occupational Safety and Health Administration Standards (OSHA)
- Plumbing Permit (DOC or local building department)

Environmental Considerations

- Air Quality Construction and/or Operating Permit (DHES)
- Beneficial Water Use Permit (DNRC)
- Hazardous Waste Management Facility Permit (DHES)
- Hazardous Waste Reporting Requirements (DHES)
- Montana Groundwater Pollution Control System (MGWPCS) Permit (DHES)
- Montana Pollutant Discharge Elimination System (MPDES) Permit (DHES)
- National Pollutant Discharge Elimination System (NPDES) Permit (DHES)
- Nonattainment Permitting Requirements (DHES)
- Odor Control (DHES)
- PM-10 Air Quality Standards (DHES)
- Prevention of Significant Deterioration (PSD) Review (DHES)
- Solid Waste Management System License (DHES)
- Stream Protection Act Permit (DFWP)
- Streambed and Land Preservation Permit (310 Permit) (normally, local conservation district)

Special Concerns

- Business Licensing Requirements (DOC and local government)
- Electrical Energy Producer's License (DOR)
- Fire Hazard Reduction/Certificate of Clearance (DSL)
- Fire Safety Inspections (DOJ, state fire marshall, municipal fire chief, or county sheriff)
- Timber Removal Permit (DSL or Board of County Commissioners)

DIRECT COMBUSTION: BOILERS AND FURNACES

Biomass such as wood, garbage, manure, straw, and biogas can be burned without processing to produce hot gases for heat or steam, as shown in Figure 7. This process ranges from burning wood in fireplaces to burning garbage in a fluidized bed boiler to produce heat or steam to generate electric power. Direct combustion is the simplest biomass technology and may be very economical if the biomass source is nearby.

Direct combustion is the most common technology used for bioenergy in Montana. Approximately 664,000 oven-dry tons of wood waste are burned annually at 32 industrial and institutional sites in Montana for process steam, drying, air conditioning (adsorption cooling), and space heat. Another 380,000 oven-dry tons of wood are used annually for heating in about 51 percent of all Montana residences (1986-1989). Wood is a primary heat source in 38 percent of Montana residences. Almost all of this residential supply is derived from forest residues produced each year in Montana by forest fires, insects and disease, and timber harvest lumber activities (See Appendix C, Figure 15). Expanded use of wood residues for industrial and institutional applications is possible in Montana. Bark and sawdust from sawmills amount to 242,000 oven-dry tons (12-year average) per year (*Montana Bioenergy Facilities*, DNRC forthcoming). Over 5,000 pounds-per-acre of straw are produced in Montana grain fields and could be removed for fuel (*Energy from Crops and Agricultural Residues in Montana*, Haines 1987) (see Appendix C, Table 16). The straw production areas are shown in Appendix C, Figure 16.

Selected information on Montana bioenergy projects is in Appendix A. Detailed information on bioenergy projects is in the DNRC publication, *Montana Bioenergy Facilities* (DNRC forthcoming). Table 7 contains a list of permits, licenses, and issues covered in this guidebook that relate to direct combustion of biomass.

Environmental Permits

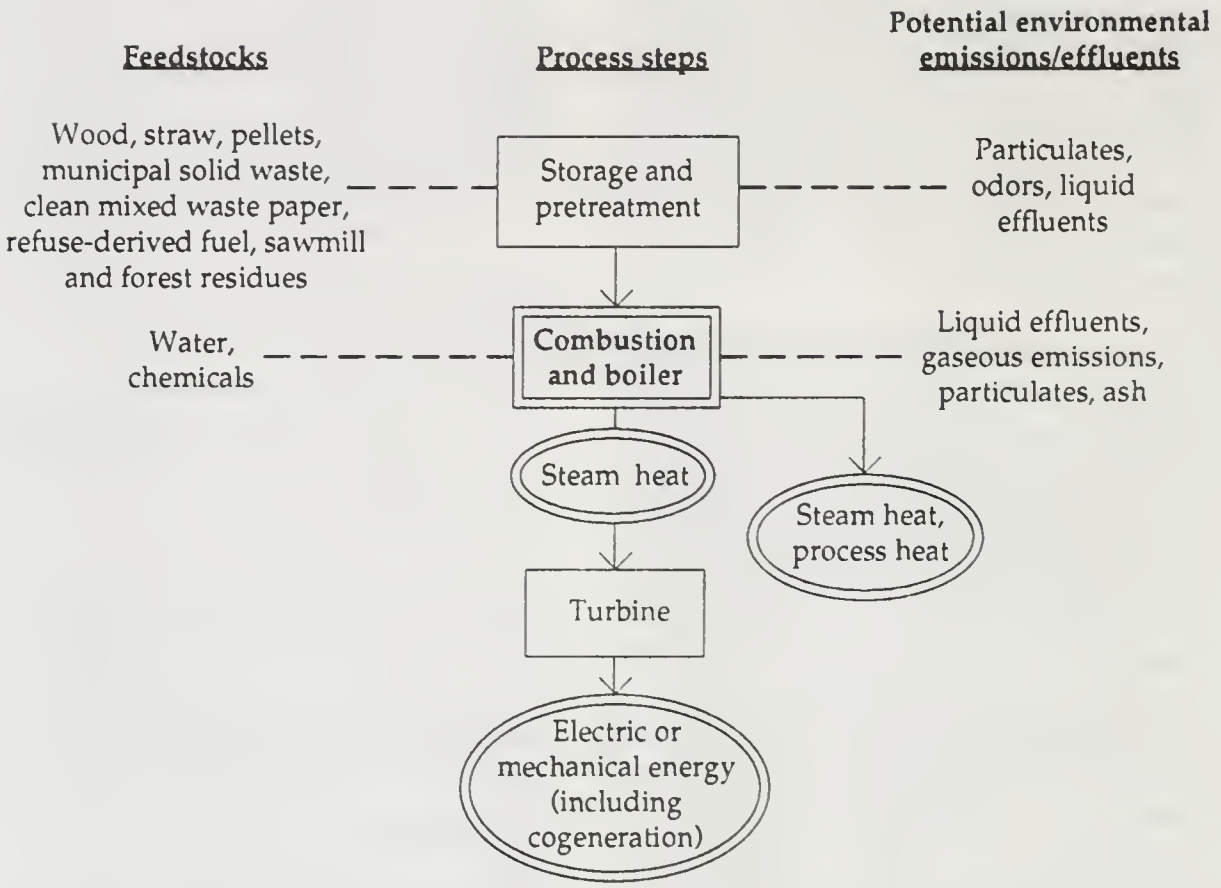
Biomass-fired furnaces and boilers must meet state emission and air quality regulations. A permit is required from DHES, Air Quality Bureau for furnaces and boilers that have a heat input of 10,000,000 Btus per hour if they are burning liquid or gaseous fuels or 5,000,000 Btus per hour for solid fuel burners. The rule concerning particulate emissions from new fuel-burning installations, shown in Figure 13, may be applied, but BACT standards are most applicable to bioenergy projects. Because BACT may be more stringent than values shown in Figure 13, all point sources must use BACT first to be sure of meeting particulate emission requirements. (See Air Quality, page 41.)

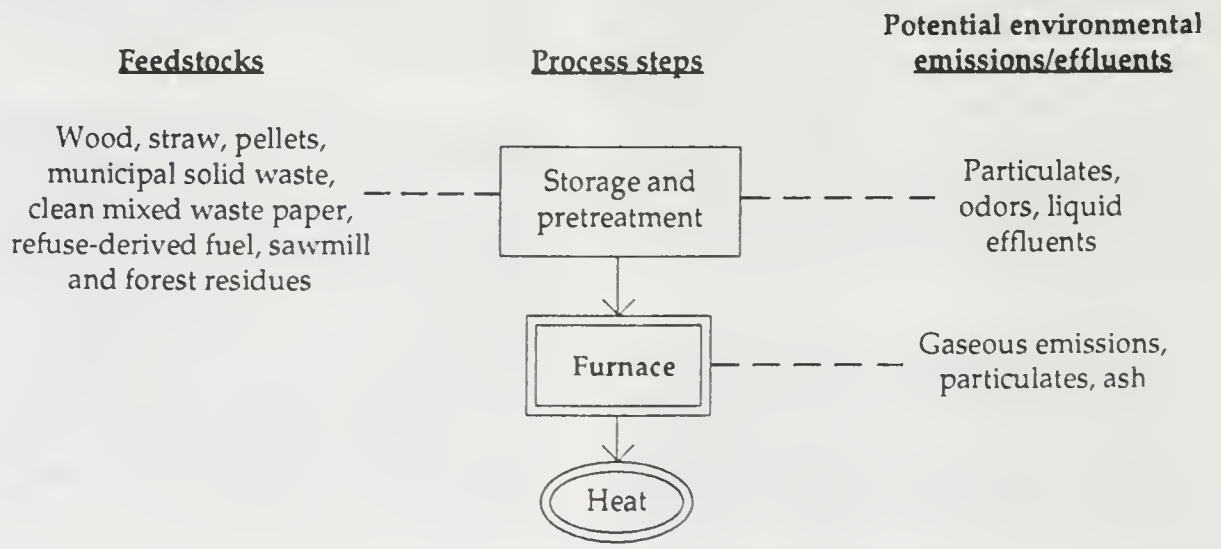
Prevention of Significant Deterioration (PSD) standards and National Ambient Air Quality Standards (NAAQS) apply to major new sources of air pollution. A facility that burns solid fuel may need to comply with PM-10 ambient air quality standards established by EPA. These standards are for particulate matter with an aerodynamic diameter of 10 microns or less. (See Air Quality, pages 44 and 46.) Some municipalities have also adopted their own air pollution control programs. (See Urban Areas/ Municipalities, page 76.) Special consideration may need to be given to odor control. (See Air Quality, pages 40 and 42.)

Disposing of ash and fly ash that might include solid or hazardous wastes is complex, and disposal may create unexpected costs. Waste generators are legally liable for the proper disposal of waste. Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. Any facility storing solid waste, such as refuse-derived fuel or hog fuel, may require a solid waste management system license. Discharges of pollutants into state waters from a point source are regulated by the Montana Water Quality Act and require an

FIGURE 7

DIRECT COMBUSTION


Feedstocks
Process steps
Potential environmental emissions/effluents
Wood, straw, pellets, municipal solid waste, clean mixed waste paper, refuse-derived fuel, sawmill and forest residues
Storage and pretreatment
Particulates, odors, liquid effluents
Water, chemicals
Combustion and boiler
Liquid effluents, gaseous emissions, particulates, ash
Steam heat
Steam heat, process heat
Turbine
Electric or mechanical energy (including cogeneration)



MGWPCS Permit. (See Waste Management, page 47 and 63 and Water Quality, pages 50 and 65.) Wastes classified as hazardous require detailed reporting for disposal. For a definition of solid waste and information on the law, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

All furnaces and boilers must have local building permits. The type and location of the project will determine specific permit and zoning needs. Boilers and boiler operators must be licensed by DOLI, Safety Bureau. (See Occupational Safety and Health, pages 62 and 75.)

Special Issues

Timber and slash removal permits are required from the appropriate state or federal agency for commercial harvesting of trees or forest residue from state and federal forests. (See Forest Clearing and Burning, page 59 and Forested Areas, page 73.)

Direct combustion processes that produce electricity may be required to pay an electrical energy producer's license tax. Montana law states that each person or organization engaged in the generation, manufacture, or production of electricity and electric energy for barter, sale, or exchange must pay an electrical energy producer's tax of $.0002 per kilowatt-hour. For information, contact DOR, Natural Resource and Corporation Tax Division.

TABLE 7

DIRECT COMBUSTION PERMITS, LICENSES, AND SPECIAL ISSUES

Construction and Land Use

- Boiler Operating Certificate (DOLI)
- Boiler Operator's License (DOLI)
- Building Permit (DOC or local building department)
- Electrical Permit (DOC or local building department)
- Floodplain Development Permit (DNRC)
- Lakeshore Development Permit (local government)
- Mechanical Permit (DOC or local building department)
- Occupational Safety and Health Administration Standards (OSHA)
- Plumbing Permit (DOC or local building department)

Environmental Considerations

- Air Quality Construction and/or Operating Permit (DHES)
- Beneficial Water Use Permit (DNRC)
- Hazardous Waste Management Facility Permit (DHES)
- Hazardous Waste Reporting Requirements (DHES)
- Montana Groundwater Pollution Control System (MGWPCS) Permit (DHES)
- Montana Pollutant Discharge Elimination System (MPDES) Permit (DHES)
- National Pollutant Discharge Elimination System (NPDES) Permit (DHES)
- Nonattainment Permitting Requirement (DHES)
- Odor Control (DHES)
- PM-10 Air Quality Standards (DHES)
- Prevention of Significant Deterioration (PSD) Review (DHES)
- Solid Waste Management System License (DHES)
- Stream Protection Act Permit (DFWP)
- Streambed and Land Preservation Permit (310 Permit) (normally, local conservation district)

Special Concerns

- Business Licensing Requirements (DOC and local government)
- Electrical Energy Producer's License (DOR)
- Fire Hazard Reduction/Certificate of Clearance (DSL)
- Fire Safety Inspections (DOJ, state fire marshall, municipal fire chief, or county sheriff)
- Timber Removal Permit (DSL or Board of County Commissioners)

GASIFICATION

Gasification is the conversion of solid biomass to an intermediate gaseous product, as illustrated in Figure 8. The process involves controlled combustion of the biomass under operating conditions that yield gas consisting of carbon monoxide (CO) and hydrogen (H_2). Depending on the conditions of gasification, either low Btu gas (200 Btus per cubic foot) or medium Btu gas (600 Btus per cubic foot) is produced. Both low and medium Btu gas can be used directly to produce electricity, mechanical energy, or process heat. Medium Btu gas can also be converted to either methane by the gas shift process or liquid methanol by the methanol synthesis process.

While gasification technology has been used since World War II, it is considered a developing technology because few reliable and efficient commercial gasifiers are in operation. Gasification is a developing technology in Montana.

A new pilot-scale gasification process, called the Skygas™ process, is being tested in Montana. In this process, biomass enters a primary reactor where electric, thermal, and chemical reactions are initiated and maintained by electric arcs. The resulting medium Btu gas consists largely of hydrogen and carbon monoxide. It is passed through a secondary reactor where it reacts with petroleum coke and an electric arc at high temperature. This produces a gas largely of methane, hydrogen, and carbon monoxide. The gas is run through a charcoal filter before use in engines. The pilot-scale system can process 2 to 3 tons of biomass wastes per hour that have included wood chips, shredded tiles, medical wastes, and garbage. The first commercial application of this process is a 350 ton-per-day facility south of Milan, Italy.

Selected information on Montana bioenergy projects is in Appendix A. Detailed information on bioenergy projects is in the DNRC publication, *Montana Bioenergy Facilities* (DNRC forthcoming).

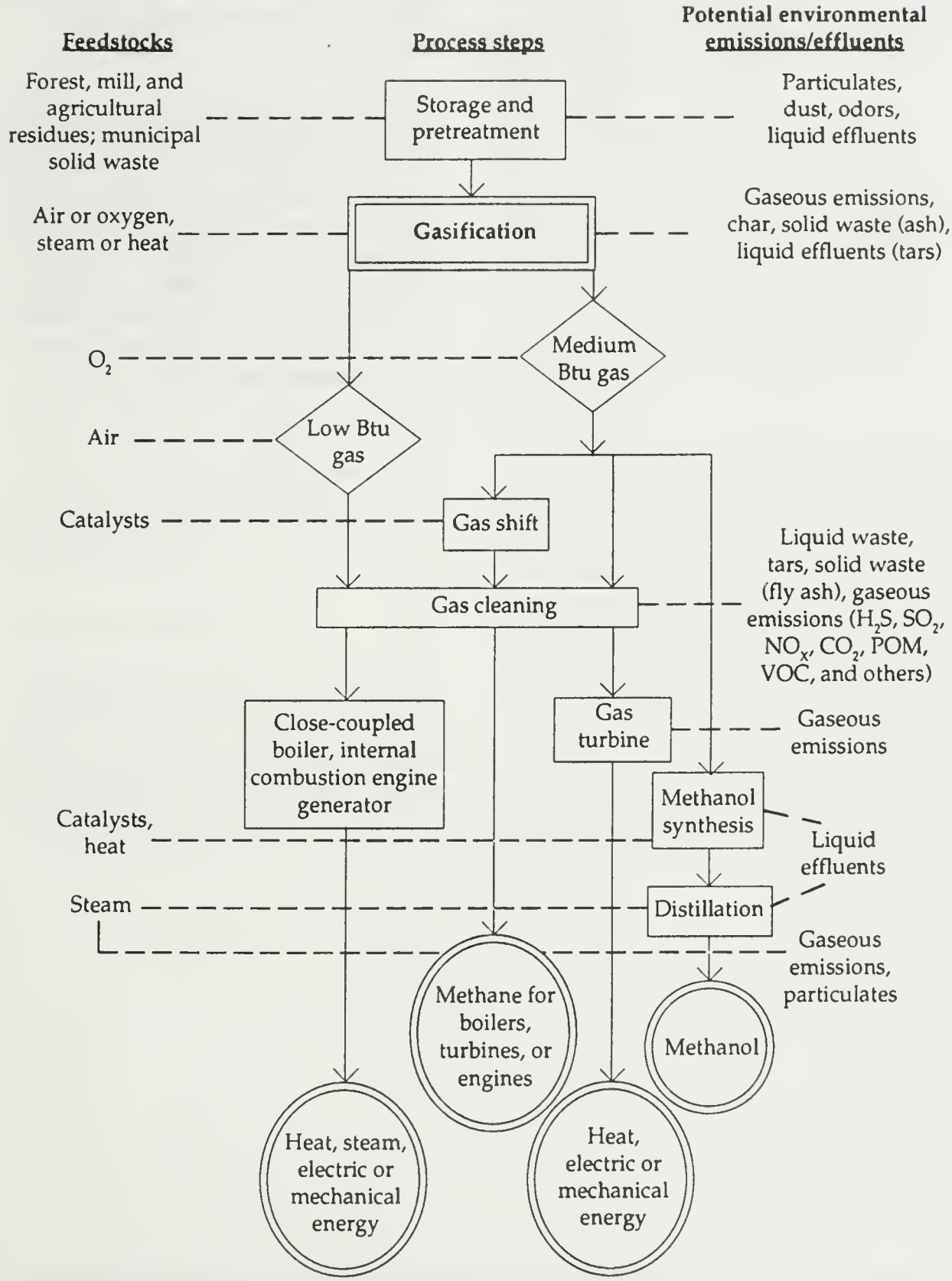
Environmental Permits

Gasification technology involves many process steps, each of which could discharge solid waste, liquid waste, and gaseous emissions. The process equipment should be designed with the best available control technology (BACT) to minimize potential air pollution. Contact DHES for the appropriate air and water discharge permits. If a facility burns solid fuel, it may be required to comply with PM-10 ambient air quality standards established by EPA. These standards are for particulate matter with an aerodynamic diameter of 10 microns or less. (See Air Quality, pages 44 and 46.) Some municipalities have also adopted their own air pollution control programs. (See Urban Areas/Municipalities, page 76.) Special consideration may need to be given to odor control. (See Air Quality, pages 40 and 42.)

Gasifiers can produce toxic and hazardous materials that cannot be disposed of in landfills. Materials listed as hazardous have detailed reporting requirements for hazardous waste disposal. Waste generators are legally liable for the proper disposal of waste. Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. Any facility storing solid waste, such as hog fuel, may require a solid waste management system license. Discharges of pollutants into state waters from a point source are regulated by the Montana Water Quality Act and require an MGWPCS Permit. (See Waste Management, pages 47 and 63 and Water Quality, pages 50 and 65.) For a definition of solid waste and information on the law, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

FIGURE 8

GASIFICATION



Construction and Land Use Permits

Gasifiers are required to comply with all building, mechanical, electrical, and plumbing codes. (See Building, Mechanical, Electrical, and Plumbing Permits, page 57.) Finding an acceptable location for a facility depends on how well potential environmental impacts can be mitigated. Boilers and boiler operators must be licensed by DOLI, Safety Bureau. (See Occupational Safety and Health, pages 62 and 75.)

Special Issues

Timber and slash removal permits are required from the appropriate state and federal agencies for commercial harvesting of trees or forest residue from state and federal forests. (See Forest Clearing and Burning, page 59 and Forested Areas, page 73.)

Gasification processes that produce electricity may be required to pay an electrical energy producer's license tax. Montana law states that each person or organization engaged in the generation, manufacture, or production of electricity and electric energy for barter, sale, or exchange must pay an electrical energy producer's tax of $.0002 per kilowatt-hour. For information, contact DOR, Natural Resource and Corporation Tax Division.

LANDFILL GAS

Landfill gas is generated by the decay (anaerobic digestion) of buried trash and garbage in landfills, as shown in Figure 9. When the organic waste decomposes, it generates gas consisting of approximately 50 percent methane, the major component of natural gas. Only the large municipal landfills in Montana have enough waste to generate significant amounts of landfill gas. Landfill gas is monitored in Billings, Helena, and Polson for its potential to cause fire or explosion. In the future, federal rules may require that all landfills be monitored for landfill gas. For more information, contact SHWB. Biogas would not be economical to develop in Montana at this time because there are no efficient methods for capturing and using the gas at a cost comparable to available natural gas. The use of landfill gas is a developing technology in Montana.

Environmental Permits

Landfill gas technology involves the capture and processing of biogas that is already being generated. Environmental permits would be required for any solid, liquid, or gaseous effluents that would leave the landfill as part of the process of gas collection and use. DHES regulates all landfills. Anyone who wants to capture or process landfill gas would have to obtain prior approval from SHWB. Special consideration may need to be given to odor control. (See Air Quality, pages 40 and 42.)

Construction and Land Use Permits

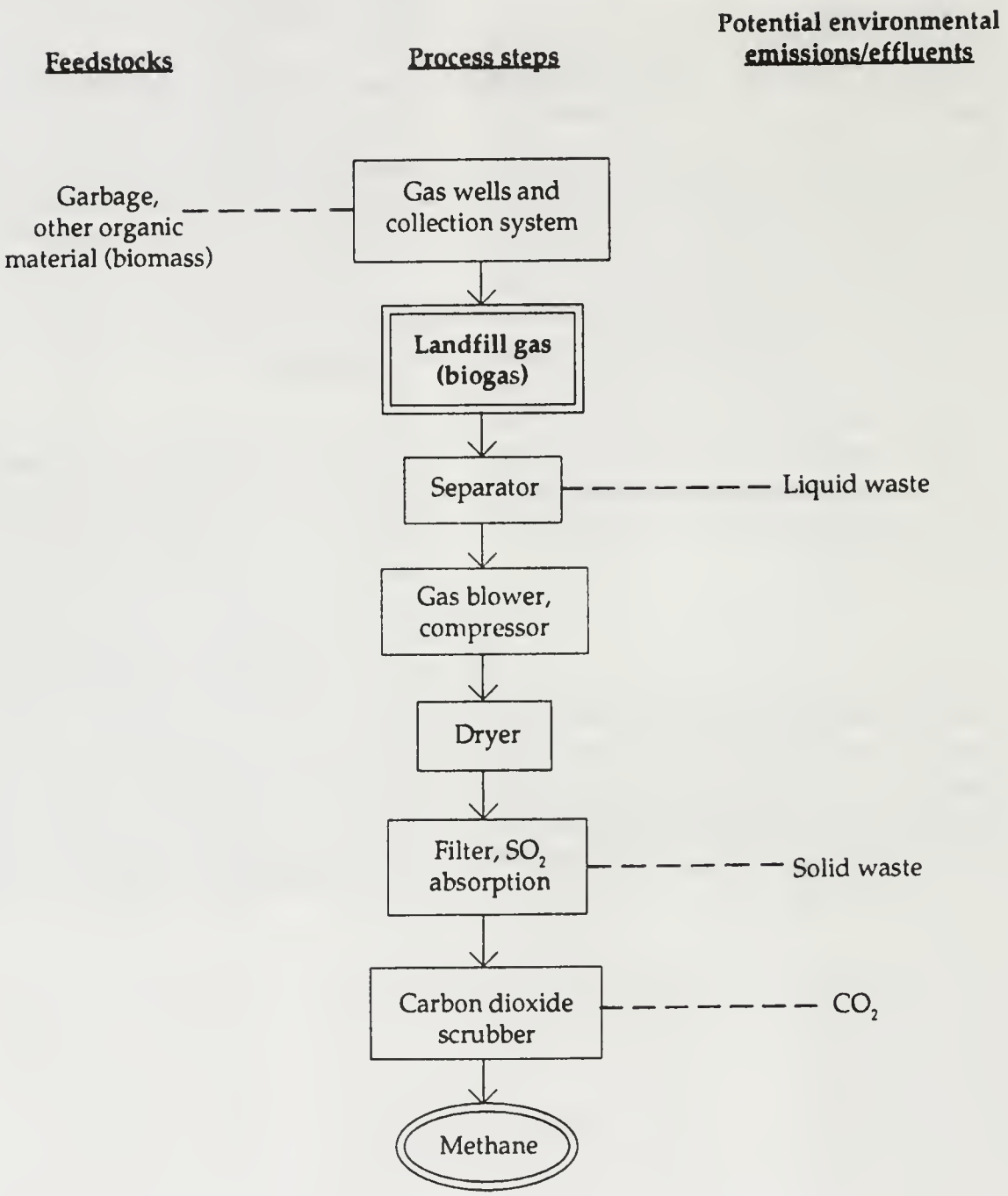
Biogas processing and handling equipment must meet building, mechanical, and electrical codes. (See Building, Mechanical, Electrical, and Plumbing Permits, page 57.) Equipment must be designed and maintained to handle the corrosive, explosive, and flammable gases.

Special Issues

Landfill taps to collect gas are considered natural gas wells and come under the jurisdiction of all the laws and rules that pertain to gas wells. Montana law (MCA 82-11-101 et seq.) requires a permit before any drilling commences. Administrative rules (ARM 36.22.601 et seq.) cover drilling, well spacing, safety, production, abandonment, and pricing. Information can be obtained from DNRC, Oil and Gas Conservation Division. A producer must pay a license tax of two-tenths of 1 percent of the market value of each 10,000 cubic feet of natural gas produced. An exemption to this tax may be possible if the project is cosponsored by a government entity.

FIGURE 9

LANDFILL GAS



LIQUEFACTION

Liquefaction is the process that adds hydrogen to organic compounds (usually solids) to obtain an oil with a high hydrogen-to-carbon ratio, as shown in Figure 10. The biomass feedstocks that can be converted with this technology are residues from forests, mills, and agriculture and municipal solid waste. Most liquefication processes take place under high pressure and temperature. Several schemes are being developed for different feedstocks, reactor designs, catalysts, and operating conditions. The Hyacles process is an example of a liquefaction process developed in Libby at laboratory scale to convert wood waste and municipal trash to a liquid fuel similar in energy content to diesel fuel. This ambient temperature and pressure process passes the biomass through a cathode that decomposes the biomass to condensable liquids, gases, and activated carbon. Liquefaction is a developing technology in Montana.

Environmental Permits

Environmental emissions from a biomass liquefaction facility depend on the feedstock and specific liquefaction process used. Air and water discharge permits will be required for gaseous emissions and liquid waste streams. (See Air Quality, pages 39 and 54; Water Quality, pages 50 and 65.) Special consideration may need to be given to odor control. (See Air Quality, pages 40 and 42.)

Solid and hazardous waste regulations are becoming a greater concern, and improper disposal may result in unforeseen costs. Waste generators are legally liable for the proper disposal of waste. Any facility storing solid waste, such as hog fuel, wood waste, or refuse-derived fuel, may require a solid waste management system license. Discharges of pollutants into state waters from a point source are regulated by the Montana Water Quality Act and require an MGWPCS Permit. (See Waste Management, pages 47 and 63 and Water Quality, pages 50 and 65.) Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. Wastes classified as hazardous have detailed reporting requirements for disposal. For a definition of solid and hazardous waste and information on the laws, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

New technologies, especially ones with potential environmental impacts, will be carefully scrutinized by state and local officials and the public. Allow plenty of time in the planning process for public hearings and comment periods, and for working closely with local planning and zoning departments to get land use permits.

Boilers and boiler operators must be licensed by DOLI, Safety Bureau. (See Occupational Safety and Health, pages 62 and 75.)

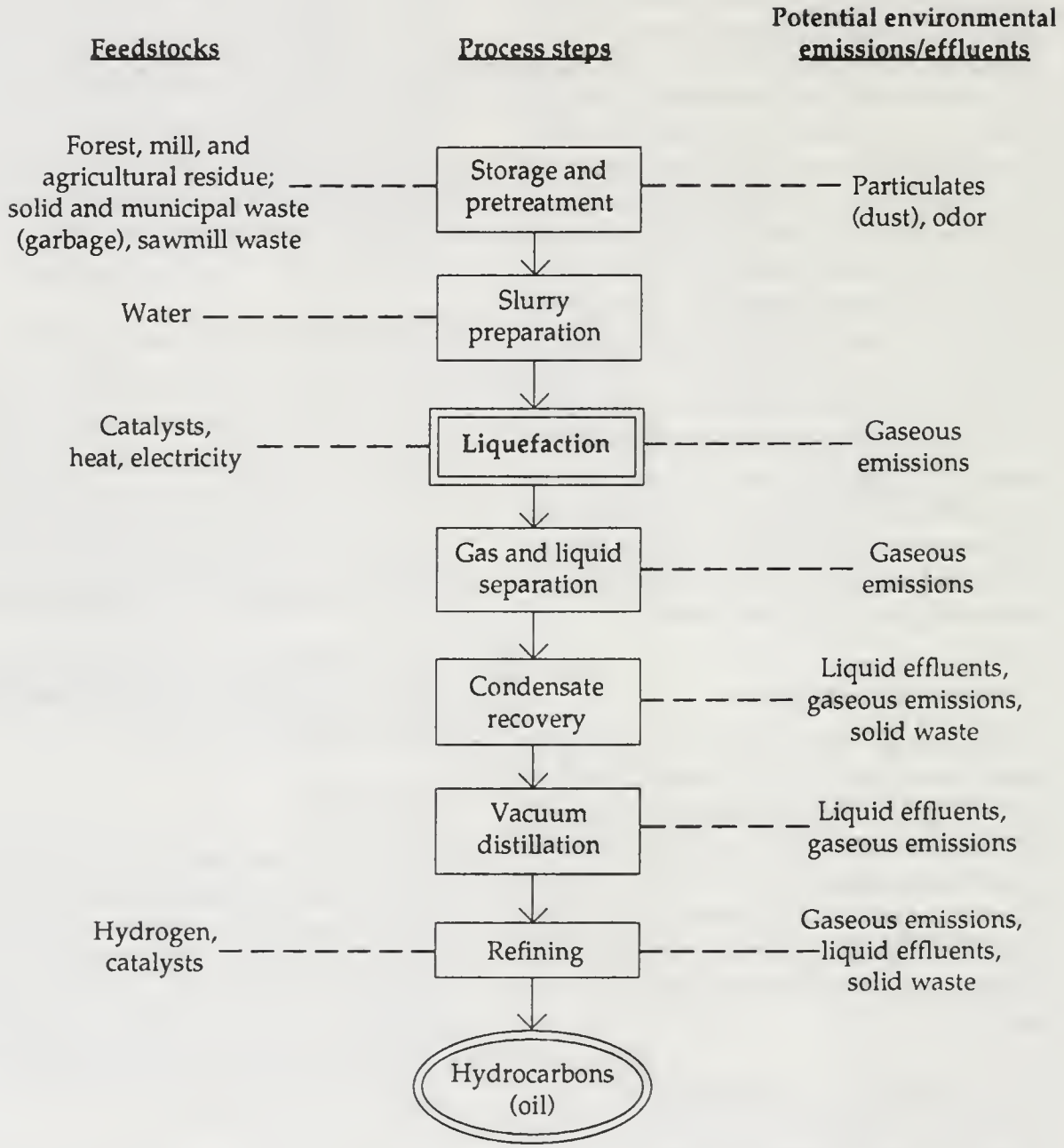
Special Issues

Bioenergy facilities usually do not fall under Montana's Major Facility Siting Act. However, if the liquefaction plant produces more than 25,000 barrels per day of liquid hydrocarbons, a Certificate of Public Need and Environmental Compatibility may be required from the Board of Natural Resources and Conservation. (See Major Facility Siting, page 61.)

Timber and slash removal permits are required from the appropriate state or federal agency for commercial harvesting of trees or forest residue from state and federal forests. (See Forest Clearing and Burning, page 59 and Forested Areas, page 73.)

FIGURE 10

LIQUEFACTION*



* Yet to be proven commercially

OILSEED EXTRACTION

Oilseeds can be pressed and the extract treated with a solvent to produce a vegetable oil that can be refined for use as a food product or a diesel fuel substitute, as shown in Figure 11. Of the bioenergy technologies reviewed in this report, only oilseed extraction has the potential to provide a diesel fuel substitute that does not require significant engine modification. However, the present price of petroleum-based fuel makes the oil from seed extraction uneconomical for use as diesel fuel. Extraction of seed oil for energy use is a developing technology in Montana.

Oilseed plant varieties grown in Montana include safflower, sunflower, rapeseed (canola), flax, and mustard. Safflower appears to be the best of these for Montana. DNRC sponsored research at the Eastern Agricultural Research Center (EARC) in Sidney, Montana, to develop 20 new high oleic safflower varieties for use as a petroleum substitute. Vegetable oil with a high oleic fatty acid content is more compatible with diesel engines than ordinary safflower and sunflower oils, which are high in linoleic fatty acid (i.e., have more than one double bond chain). Companies are negotiating to have EARC develop an exclusive line of high oleic safflower oil for their use in paints, solvents, and inks. Montana has 8.5 million acres suitable for safflower. (See Appendix C, Figure 17.) This acreage could produce 171.2 million gallons of oil if it were planted on a 3-year rotation with wheat or barley. Canola (or winter rapeseed) is also gaining interest in Montana; a Canadian firm is building a canola plant near Butte. Canola will grow on only about 4 million acres in Montana (see Appendix C, Figure 18), because it needs a cooler and wetter growing season than safflower (*Montana's Fuel Safflower Activities*, Haines 1989). For more information on oilseed production opportunities, contact EARC at the address listed in Appendix B.

Environmental Permits

Emissions from an oilseed extraction process should be minimal. Solid coproducts normally would be recovered and marketed as animal feed. Wastewater will have a high biological oxygen demand (BOD) and will require water discharge permits. (See Water Quality, pages 50 and 65.) If a facility discharges particulates from raw materials, it may need to comply with PM-10 ambient air quality standards established by EPA. (See Air Quality, pages 44 and 46.)

Solid and hazardous waste regulations are becoming a greater consideration, and improper disposal may result in unforeseen costs. Waste generators are legally liable for proper disposal of waste. Any facility storing solid waste may require a solid waste management system license. Benzene or mixtures of benzene that might be used as an extraction solvent and other waste may be subject to hazardous waste management regulations. Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. Wastes classified as hazardous may have detailed reporting requirements for disposal. For a definition of solid and hazardous waste and information on the laws, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

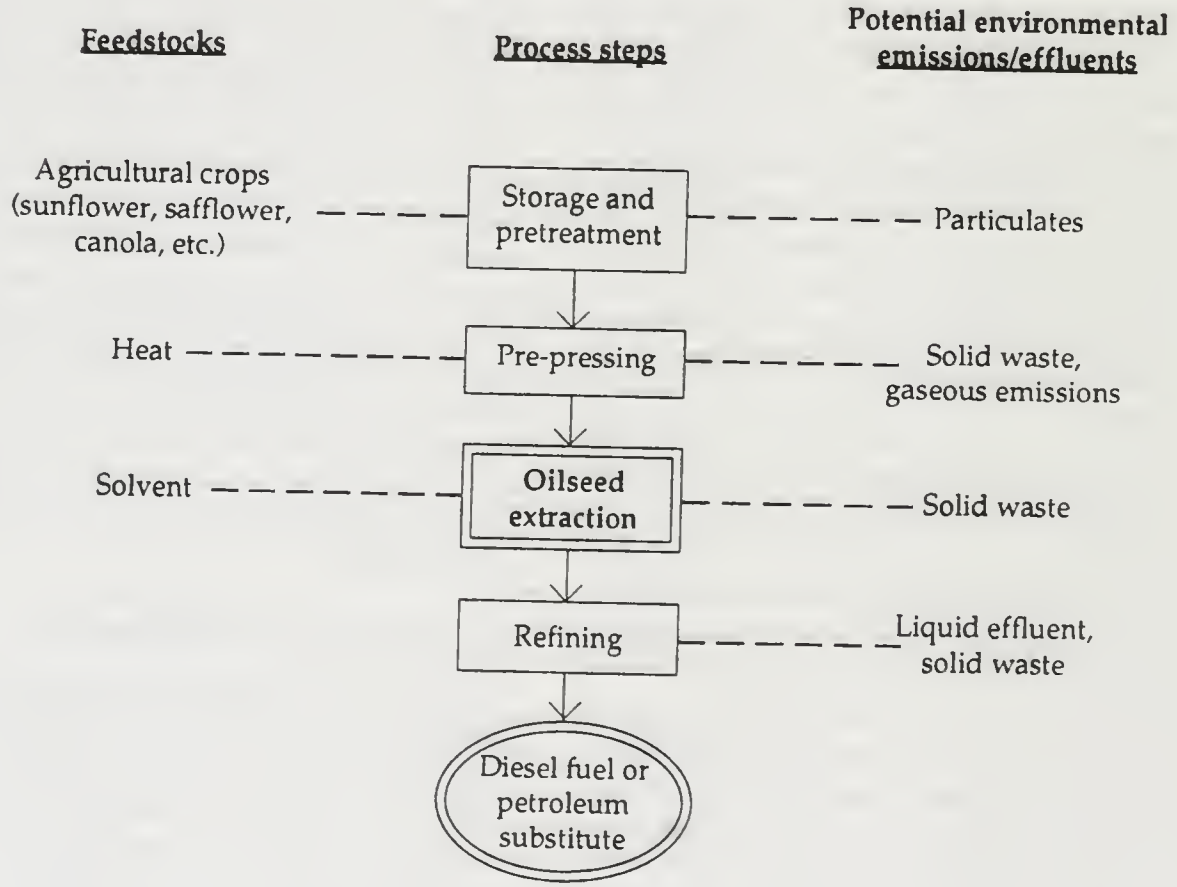
Oilseed extraction facilities probably will be located in rural or small urban areas near where the seeds are grown. Industrial development zones are not likely in such areas, so developers should plan on working closely with local planning departments or county commissioners to get permits that allow access to required utilities and water. (See Local Areas, page 74.) The plant will also require building, mechanical, electrical, and plumbing permits. (See Building, Mechanical, Electrical, and Plumbing Permits, page 57.)

Special Issues

For coproducts that are sold as commercial feed in Montana, a feed dealer's permit is required from DOA, Plant Industry Division. The commercial feed must be registered and comply with labeling format and other requirements as stated in DOA rules. Further, anyone marketing or housing grain, including oilseeds, may have to obtain an agricultural commodity dealer's license or a warehouseman's license. (See Agriculture, page 52.)

FIGURE 11

OILSEED EXTRACTION



PYROLYSIS

Pyrolysis is the thermal degradation of biomass by heat in the absence of oxygen, as shown in Figure 12. Biomass feedstocks, such as wood or garbage, are heated to a temperature between 800 and 1,400 degrees Fahrenheit (F), but no oxygen is introduced to support combustion. Pyrolysis results in three products: medium Btu gas, fuel oil, and charcoal. The amount and quality of each product depend on the biomass used and process operating conditions. Pyrolysis is a developing technology with potential for economical production of liquid transportation fuel from solid biomass.

Environmental Permits

The amount and type of environmental emissions depend on the feedstock and the size, configuration, and operating conditions of the pyrolysis reactor. Air and water discharge permits will be required from DHES. (See Air Quality, pages 39 and 54; Water Quality, pages 50 and 65.) If a facility discharges particulates, it may need to comply with PM-10 ambient air quality standards established by EPA. These standards are for particulate matter with an aerodynamic diameter of 10 microns or less. (See Air Quality, pages 44 and 46.) Special consideration may need to be given to odor control. (See Air Quality, pages 40 and 42.)

Disposal of solid or hazardous wastes, such as ash and fly ash, is complex, and improper disposal may create unexpected costs. Waste generators are legally liable for proper disposal of waste. Solid waste disposal permits are not required if wastes are disposed of at licensed facilities. Any facility storing solid waste, such as refuse-derived fuel or hog fuel, may require a solid waste management system license. Wastes classified as hazardous require detailed reporting for disposal. Discharges of pollutants into state waters from a point source are regulated by the Montana Water Quality Act and require an MGWPCS Permit. (See Waste Management, pages 47 and 63 and Water Quality, pages 50 and 65.) For a definition of solid and hazardous waste and information on the law, rules, and exceptions, see Waste Management, pages 47 and 63. For more information on specific wastes or facilities, contact SHWB.

Construction and Land Use Permits

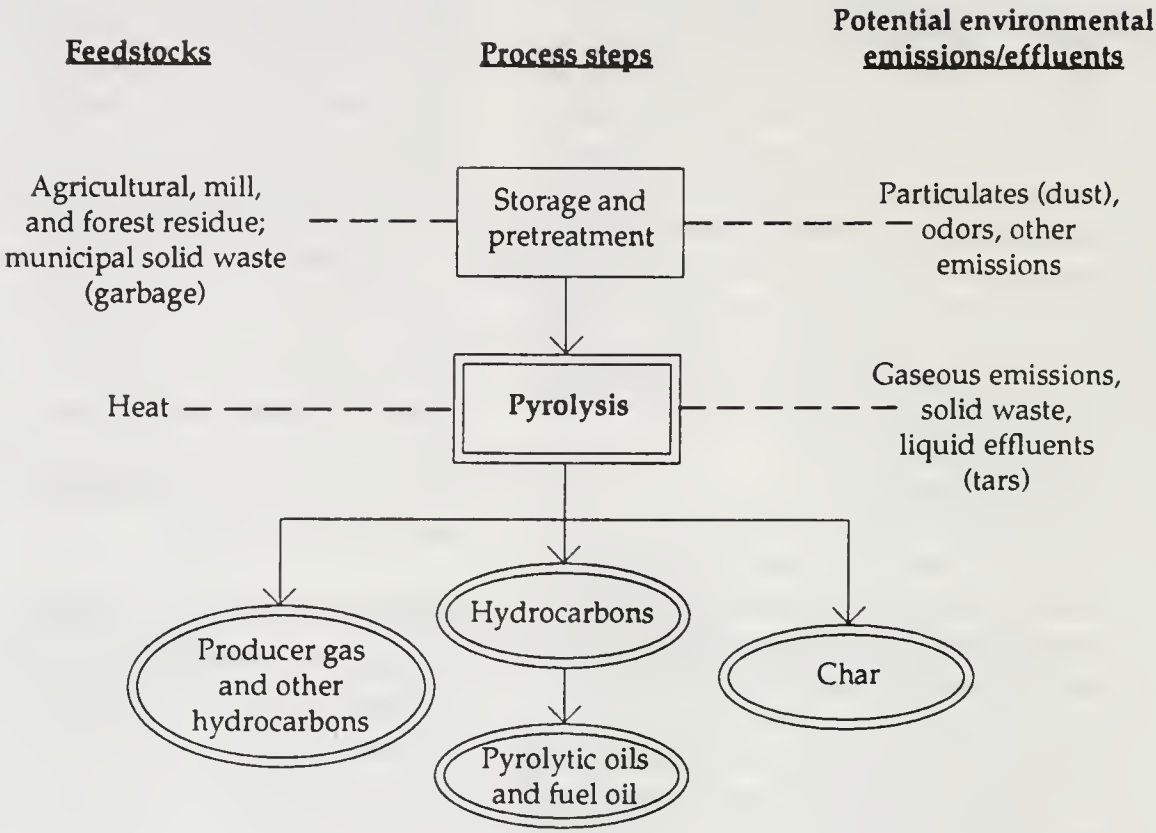
The local planning department must approve all siting and land use permits. Building, mechanical, electrical, and plumbing permits also are necessary before construction begins. (See Building, Mechanical, Electrical, and Plumbing Permits, page 57.)

Special Issues

Timber and slash removal permits are required from the appropriate state and federal agencies for commercial harvesting of trees or forest residue from state and federal forests. (See Forest Clearing and Burning, page 59 and Forested Areas, page 73.)

FIGURE 12

PYROLYSIS*



* Yet to be proven commercially

SECTION 3
ENVIRONMENTAL CONSIDERATIONS

INTRODUCTION

This section addresses the potential environmental impacts of bioenergy technologies, emphasizing air and water quality and waste management. It also includes state and federal environmental laws and regulations that pertain to bioenergy projects in Montana.

A bioenergy facility may be a cost-effective way to meet your energy needs. The facility could provide energy as steam, heat, or electricity; reduce reliance on fossil fuels; provide jobs; or improve air quality. However, bioenergy facilities also may have some adverse effects. Bioenergy technologies have the potential to produce air and water pollutants, and the processes involved in these technologies may produce solid, liquid, or hazardous wastes. Table 8 lists the various bioenergy technologies and their potential environmental emissions.

Each project is unique and may require a detailed analysis of air quality, water quality, geology, location of the facility, and other factors. Bioenergy project developers should contact the appropriate DHES bureaus and other agencies to find out the possible environmental constraints on their proposed project.

Other environmental and site-specific considerations must be included in the project's economic evaluation because they may result in unique economic or financing demands. Noise caused by construction, equipment operation, and trucks may require mitigation. The bioenergy facility may require community services or may present health or safety hazards.

The Montana Environmental Policy Act (MEPA) (MCA 75-1-101 et seq.) applies to any major state agency action that might significantly affect the quality of the human environment. All the state agencies have adopted rules implementing this act and defining the circumstances that require an environmental assessment (EA) or an environmental impact statement (EIS). They also establish fees, comment periods, public hearings, and time requirements. For information, contact the Montana Environmental Quality Council (EQC).

AIR QUALITY

Overview

A permit from DHES, Air Quality Bureau is required for the construction, installation, and operation of equipment or facilities that may directly or indirectly cause or contribute to air pollution. A city or county may impose standards that are equal to or stricter than DHES standards through its own air pollution permit

TABLE 8

BIOENERGY TECHNOLOGIES AND POTENTIAL ENVIRONMENTAL EMISSIONS

Technology	Potential Environmental Emissions								
	Water Pollution Discharge	Air Pollution*						Solid Waste Disposal	Hazardous Waste
		Sulfur Oxides	Nitrogen Oxides	PAH** Organics	Particulates***	Odor	Carbon Monoxide		
Alcohol fermentation	•	•	•	•	•	•	•	•	•
Anaerobic digestion	•				•	•		•	
Cogeneration		•	•	•	•	•	•	•	•
Densification		•	•	•	•	•	•	•	
Direct combustion		•	•	•	•	•	•	•	•
Gasification	•	•	•	•	•	•	•	•	•
Landfill gas	•					•		•	
Liquefaction	•	•	•	•	•	•	•	•	•
Oilseed extraction	•				•	•		•	•
Pyrolysis	•	•	•	•	•	•	•	•	•

* Potential air pollution depends on the size of burner and type of fuel.

** PAH means polyaromatic hydrocarbons.

*** Particulates include both total suspended particulates (TSP) and particulate matter less than 10 microns in diameter (PM-10).

program in lieu of the DHES permit program. (See Urban Areas/Municipalities, page 76.) EPA generally has jurisdiction over air quality on Indian reservations. (See Indian Reservations, page 74.)

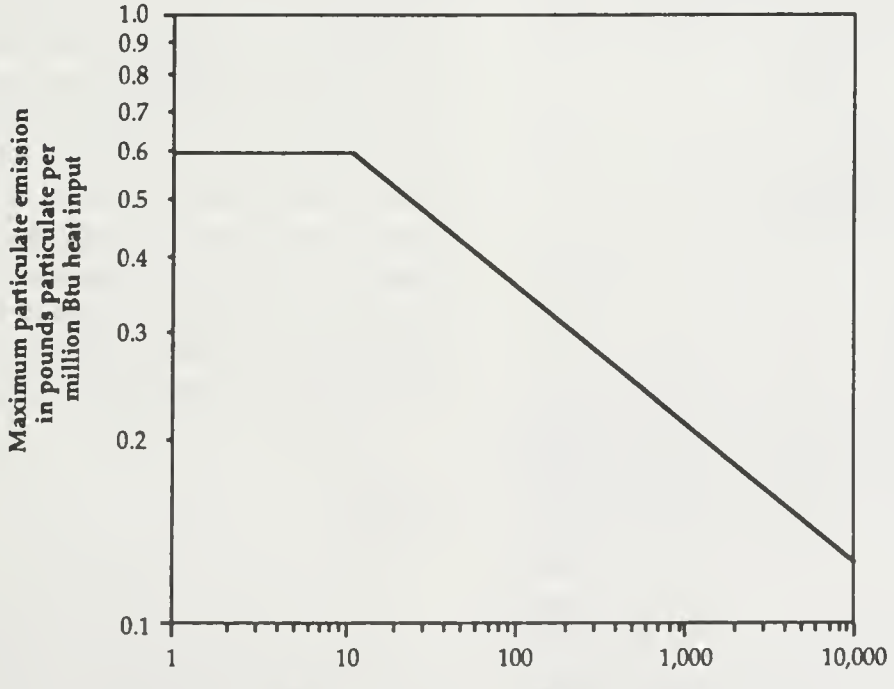
An air quality permit to construct or operate a new or altered air pollution source cannot be issued unless the source is able to comply with the ambient air quality standards, emission limitations, and other rules adopted under the Montana Clean Air Act and the applicable requirements of the Federal Clean Air Act. Some exceptions are listed in the rules.

Ambient air quality refers to the condition of the air in the surrounding environment. Title I of the Federal Clean Air Act Amendment of 1990 includes provisions for attaining and maintaining the national ambient air quality standards (NAAQS). (See Air Quality Laws and Regulations, page 43.) These ambient air standards apply indirectly to a bioenergy facility. The emissions of any new facility will have to be analyzed to determine how those emissions will affect the air quality of the surrounding area.

Emissions are substances discharged into the environment as waste material, such as flue gas and particulates from smokestacks. For permitting purposes, potential emissions of air pollutants from a bioenergy facility should be calculated at maximum design capacity of fuel input after application of BACT. The rule concerning particulate emissions from new fuel-burning installations, shown in Figure 13, may be applied, but BACT standards are most applicable to bioenergy projects. Because BACT may be more

FIGURE 13

MAXIMUM ALLOWABLE EMISSION OF PARTICULATE MATTER FROM NEW FUEL-BURNING INSTALLATIONS



Source: ARM 16.8.1403

stringent than values shown in Figure 13, all point sources must use BACT first to be sure of meeting particulate emission requirements. The air pollutants regulated by Montana are listed in Table 9, but are subject to change as new rules are developed.

TABLE 9

AIR POLLUTANTS REGULATED BY THE STATE OF MONTANA

- Asbestos
- Benzene
- Carbon Monoxide (CO)
- Fluorides
- Hydrogen Sulfide (H_2S)
- Nitrogen Oxides (NO_x)
- Ozone (O_3)
- Particulate Matter
- PM-10
- Sulfur Dioxide (SO_2)
- Sulfur-reduced Sulfur Compounds (including H_2S)
- Sulfur-total reduced Sulfur (including H_2S)
- Sulfuric Acid Mist
- Trace Metals
  - Beryllium
  - Lead
  - Mercury
  - Phosphorus
- Vinyl Chloride

Source: ARM 16.8.921 (30); 40 CFR Parts 60 and 61

State and federal air quality rules regulate visible emissions from a point source, such as a teepee burner, boiler, power plant, or any other emission source that exhausts through a stack or a vent that might exhibit a plume. Opacity limitations are listed in the air quality rules and have standards ranging from 10 to 40 percent, depending on the type and age of the source. Testing for visible emissions from a pollution source is performed by a trained observer in the field or by an in-stack monitor.

Special rules apply to wood-waste burners. DHES policy encourages the complete utilization of wood waste and restricts, wherever practical, all burning of wood wastes for disposal (incineration). State air quality rules relating to wood-waste burners place restrictions on burner construction, reconstruction, or substantial alteration; specify temperature measurement devices for combustion and stack temperatures; and establish minimum operating temperatures and maximum stack gas opacity. For the complete rules related to wood-waste burners, see ARM 16.8.1407.

During the forest fire season (May 1 through September 30 or as extended), open burning permits are required from the appropriate fire protection agency to perform prescribed forest burning to burn slash, set a land-clearing or debris-burning fire, or light any open fire. The recognized fire protection agency may be the county sheriff or board of commissioners; DSL, Forestry Division; or USFS. In addition, air quality permits are required from DHES, Air Quality Bureau for anyone qualifying as a major open burner. (See Air Quality, page 54.)

DHES also is also responsible for enforcement of odor control rules. Any business or person using any device, facility, or process that discharges odorous matter, vapors, gases, dusts, or combination of these that creates odors is subject to regulation. That person must provide, properly install, maintain, and operate odor control devices or procedures as specified by DHES.

Air Quality Laws and Regulations

The Federal Clean Air Act of 1970 governs federal and state air pollution control programs. The most recent amendment, signed into law in

November 1990, direct EPA to implement strict environmental policies and regulations to ensure cleaner air for all Americans. EPA is currently writing rules to implement all areas of the new clean air program. As those rules are written, state programs will need to comply with the new policies and rules.

Sections of the Clean Air Act most likely to have an effect on bioenergy facilities are in Titles I and II. The areas under Title I, Air Pollution Prevention and Control, that may affect bioenergy projects include sections on NAAQS, emissions, prevention of significant deterioration (PSD), air toxics, and nonattainment areas.

Title II of the Clean Air Act relates to the control of mobile source emissions such as those from cars and trucks. EPA plans to begin November 1, 1992, to lessen carbon monoxide emissions in nonattainment areas during the winter months. This program will require fuel with a 2.7 percent oxygen content. The oxygenated fuels are to be sold for a minimum of four months of the year unless EPA reduces the time frame in response to a state request. Two clean fuels programs are identified in the Clean Air Act Amendment of 1990. For these programs, "clean fuels" are defined as compressed natural gas, ethanol, methanol, liquefied petroleum gas, electricity, reformulated gasoline, and possibly other fuels. As a part of this program, Montana is required to develop a program to use oxygenated fuels in Missoula, because it is the only Montana city that violates the CO standard at this time.

EPA administers the Clean Air Act by delegating major authority to the states. Each state develops and manages its own State Implementation Plan (SIP) on approval by EPA. Areas of the state are classified according to whether they meet or exceed the NAAQS. Primary and secondary NAAQS, shown in Table 10, set limits to protect public health, plants, animals, materials, visibility, and other aspects of public welfare. NAAQS have been set for: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), PM-10 (particulate matter less than 10 microns in diameter), and lead (Pb).

States can set more, but not less, stringent ambient air standards. For carbon monoxide, ozone, and nitrogen dioxide, DHES has classified the state into three categories: (1) attainment areas that meet the standards, (2) nonattainment areas that exceed the allowable limits for pollutants, and (3) unclassified areas where information is insufficient to determine the status. For lead and PM-10, areas are classified as complying with the standards or exceeding them.

Bioenergy projects locating in nonattainment areas or other areas exceeding the standards may be required to meet more stringent air pollution emission standards, depending on local existing air quality. Detailed information on classification requirements and attainment and nonattainment areas is available from DHES, Air Quality Bureau.

Prevention of Significant Deterioration (PSD)

The purpose of the PSD program is to make sure that areas with clean air remain clean. PSD rules divide the state into two air quality classifications (see ARM 16.8.921 et seq.). Class I areas allow small increases in pollution and include national parks, some wilderness areas, and some Indian reservations. Montana's Class I areas are shown in Figure 14. The rest of Montana is designated Class II for PSD air quality purposes. (See Air Quality, page 55.)

PSD standards apply when a major new source of air pollution is proposed where ambient air quality is better than the national ambient air quality standards. These standards generally

TABLE 10

MONTANA AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Montana Standard	Federal Primary Standard	Federal Secondary Standard
Total suspended particulates	50 $\mu g/m^3$ annual average	50 $\mu g/m^3$ annual average	Same as primary standard
10 microns or less (PM-10)	150 $\mu g/m^3$ 24-hr. average*	150 $\mu g/m^3$ 24-hr. average*	Same as primary standard
Sulfur dioxide	0.02 ppm annual average 0.10 ppm 24-hr. average* 0.50 ppm 1-hr. average**	0.03 ppm annual average 0.14 ppm 24-hr. average*	0.5 ppm 3-hr. average*
Carbon monoxide	9 ppm 8-hr. average* 23 ppm hourly average*	9 ppm 8-hr. average* 35 ppm 1-hr. average*	9 ppm 8-hr. average*
Nitrogen dioxide	0.05 ppm annual average 0.30 ppm hourly average	0.05 ppm annual average	Same as primary standard
Photochemical oxidants (ozone)	0.10 hourly average*	0.12 ppm 1-hour average*	Same as primary standard*
Lead	1.5 $\mu g/m^3$ 90-day average	1.5 $\mu g/m^3$ calendar quarter average	None
Foliar fluoride	35 $\mu g/g$ grazing season 50 $\mu g/g$ monthly average	None	None
Hydrogen sulfide	0.05 ppm hourly average*	None	None
Settled particulate (dustfall)	10 gm/m^2 30-day average	None	None
Visibility	Particle scattering coefficient of 3×10^{-5} per meter annual average***	None	None

gm/m^2 - grams pollutant per square meter at sample site

$\mu g/g$ - micrograms pollutant per gram of sample

$\mu g/m^3$ - micrograms pollutant per cubic meter of sampled air

ppm - parts pollutant per million parts of sampled air

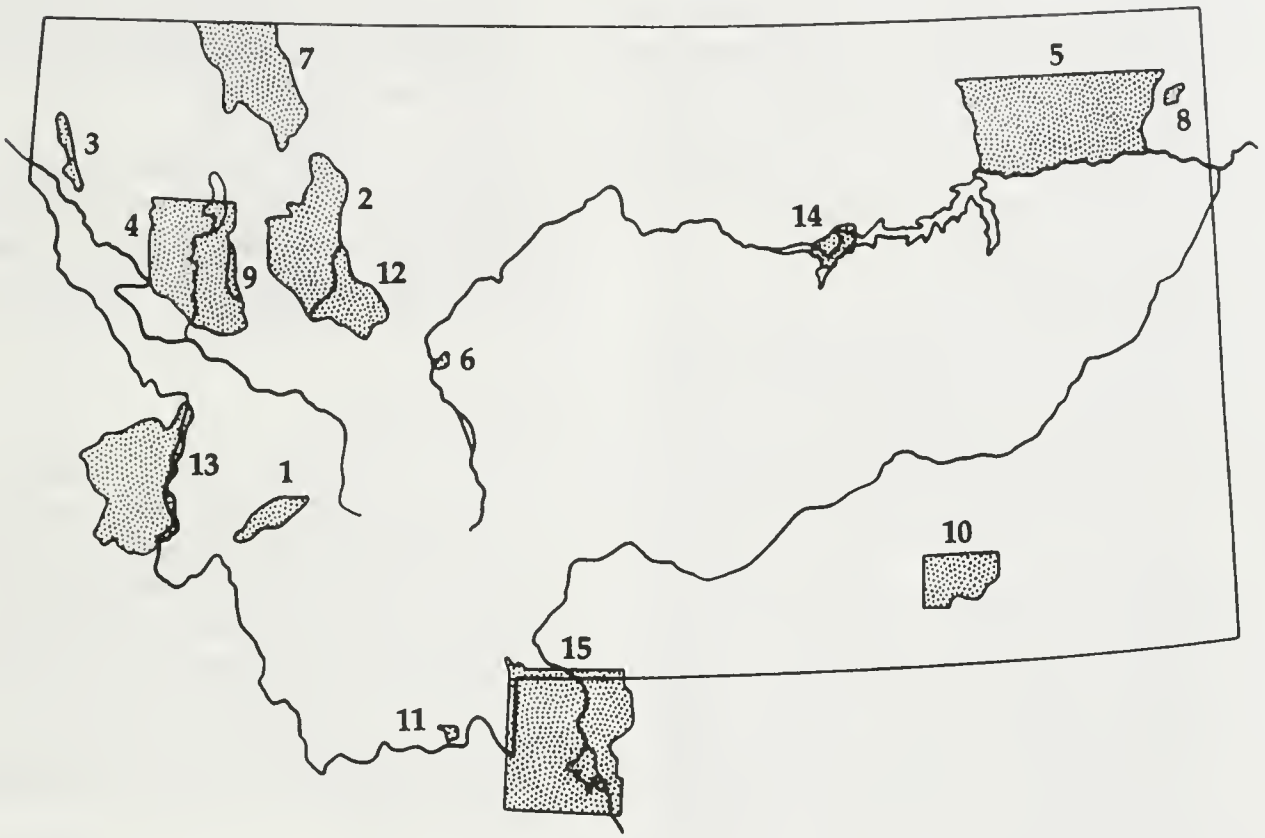
* Not to be exceeded more than once per year

** Not to be exceeded more than 18 times per year

*** Applies to PSD mandatory Class I areas

FIGURE 14

MONTANA PSD CLASS I AREAS



1. Anaconda-Pintler Wilderness
2. Bob Marshall Wilderness
3. Cabinet Mountain Wilderness
4. Flathead Indian Reservation
5. Fort Peck Indian Reservation
6. Gates of the Mountains Wilderness
7. Glacier National Park
8. Medicine Lake Wilderness Area
9. Mission Mountain Wilderness
10. Northern Cheyenne Indian Reservation
11. Red Rock Lakes Wilderness Area
12. Scapegoat Wilderness
13. Selway-Bitterroot Wilderness
14. UL Bend Wilderness Area
15. Yellowstone National Park

apply to large sources emitting over 100–250 tons per year of any pollutant. In these cases, a more stringent and lengthy review procedure may apply to minimize air quality degradation within the state. The review may include one year of preapplication baseline data, control technology review, and air quality impact modeling. These requirements should be considered when the project's permit calendar is developed because they may extend the permit application time requirements more than a year.

Nonattainment

The Clean Air Act Amendment of 1990 set standards and procedures to designate nonattainment areas and their boundaries. A nonattainment area is a geographic area where the quality of the air is worse than that allowed by federal air pollution standards. Prevention of significant deterioration requirements do not apply in nonattainment areas. Title I includes provisions for attaining and maintaining the NAAQS. These provisions generally apply to large sources emitting over 100 tons per year of any pollutant. For a proposed facility, these requirements include applying the Lowest Achievable Emission Rate (LAER) and arranging for emission reductions (offsets) from other existing sources in the nonattainment area that are greater than the proposed facility's emissions. The NAAQS, set to protect public health and welfare, have been established for six pollutants: ozone, carbon monoxide, particulate matter, lead, sulfur dioxide, and nitrogen dioxide.

Air Toxics

The Clean Air Act of 1970 authorized EPA to establish special standards for hazardous air pollutants. The 1990 Amendment establishes a long list of hazardous air pollutants, commonly called air toxics. Over the next 10 years, EPA will develop regulations to restrict emissions for various categories of air toxic emitting facilities. The new law applies to a "major source," or any facility that emits 10 tons per year of any single air toxic or 25 tons per year of any combination of air toxics. Other restrictions may apply to facilities with lower levels of emissions under the "area source" requirements.

Bioenergy facilities that exceed emission requirements for any of the 189 air toxics regulated by EPA may be required to install Maximum Available Control Technology (MACT) to comply with the regulations.

PM-10 Standards

On July 31, 1987, EPA wrote air quality standards for particulate matter known as PM-10. The standards changed the focus from larger particles, or total suspended particulates (TSP), to smaller, inhalable particles with an aerodynamic diameter of 10 microns or less. The size of 10 microns would be similar to one-tenth the diameter of one strand of human hair. These are invisible particulates that are proven to cause health problems.

EPA and the State of Montana have analyzed each Montana community to determine if it meets or exceeds PM-10 ambient air standards. Butte, Columbia Falls, Kalispell, Lame Deer, Libby, Missoula, Polson, Ronan, and Thompson Falls exceed the PM-10 ambient air standards and are designated as nonattainment areas. (See Table 11.) All other communities are designated as meeting the standards.

DHES is responsible for development of the PM-10 ambient air standards compliance plans, except for Missoula where the Missoula County Health Department has authority, and except for the following communities located on

TABLE 11

AREAS EXCEEDING NATIONAL AMBIENT AIR QUALITY STANDARDS

City	Carbon Monoxide (CO)	Sulfur Dioxide (SO_2)	Lead (Pb)	Particulates	
				PM-10*	TSP**
Billings	•				•
Butte				•	•
Colstrip					•
Columbia Falls				•	•
East Helena		•	•		•
Great Falls	•				•
Kalispell				•	
Lame Deer				•	
Laurel		•			
Libby				•	
Missoula	•			•	•
Polson				•	
Ronan				•	
Thompson Falls				•	

* PM-10—particles with an aerodynamic diameter of 10 microns or less

** TSP—total suspended particulates

Indian reservations where EPA retains authority: Polson, Ronan, Lame Deer, and Hays. The PM-10 SIP development process is more significant to bioenergy projects because PM-10 particulate matter is a common pollutant from bioenergy projects and numerous parts of the state are already designated nonattainment.

WASTE MANAGEMENT

Solid Waste Disposal (Nonhazardous)

Solid waste that is not listed as hazardous includes, but is not limited to, garbage; rubbish; refuse; ashes; sludge from sewage treatment plants, water supply treatment plants, or air pollution control facilities; construction and demolition wastes; dead animals, including offal; discarded home and industrial appliances; wood products or wood by-products; and inert materials. Solid waste does not mean municipal sewage, industrial wastewater effluents, mining wastes regulated under the mining and reclamation laws administered by the Department of State Lands (DSL), slash and forest debris regulated under laws administered by DSL, or marketable by-products.

A Solid Waste Management System License is required from DHES, Solid and Hazardous Waste Bureau, to establish and operate a solid waste management system facility. Sites for these facilities must be approved and licensed by DHES and validated by local health officials. Resource recovery systems that control the storage, treatment, recycling, or recovery of solid wastes are called solid waste management systems.

Any bioenergy facility storing solid waste, such as hog fuel, wood waste, or refuse-derived fuel, may require a Solid Waste Management System License. For more information on specific wastes or facilities, contact DHES, Solid and Hazardous Waste Bureau.

Facilities that produce solid waste must dispose of it at a licensed solid waste management facility. Solid waste must be transported in a manner that prevents it from discharging, dumping, spilling, or leaking from the transport vehicle. A possible exception may apply for a person who owns or leases more than 5 acres of land that is

not within a subdivision. Under certain conditions, that person may dispose of his own solid waste that is generated in reasonable association with his household or agricultural operations on his own land as long as the disposal does not create a nuisance or public health hazard.

Discharges of pollutants into state waters from a point source are regulated by the Montana Water Quality Act and require either a Montana Pollutant Discharge Elimination System (MPDES) Permit or a Montana Groundwater Pollution Control System (MGWPCS) Permit. (See Water Quality, pages 50 and 65.) Problems may occur if leachate or contaminated water is produced when rain or other water passes through solid waste. The leachate can include various minerals, organic matter, or other contaminants and can contaminate surface water or groundwater.

DHES specifies that owners and operators of certain municipal solid waste landfills and other disposal sites that accept household waste must monitor groundwater. This regulation applies to facilities that were in operation on October 1, 1989, and serve a geographic area with 5,000 or more people. See MCA 75-10-207 for details of the monitoring requirements.

Hazardous Waste Disposal

Hazardous waste is a waste that may cause or contribute to death or serious illness. Further, it may pose a substantial hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. A waste is categorized as hazardous if it is included in the EPA rules listing specific hazardous wastes or if standard tests show it to be ignitable, corrosive, reactive, or toxic. Hazardous waste may occur as a solid, liquid, gas, or semi-solid.

The Montana Hazardous Waste Act (MCA 75-10-401 et seq.) and the corresponding rules (ARM 16.44.101 et seq.) were adopted to administer and enforce a hazardous waste program pursuant to the federal Resource Conservation and Recovery Act (RCRA) of 1976. DHES regulates the permitting and siting of hazardous waste management facilities. These facilities are required to comply with detailed reporting and monitoring requirements.

Any operation generating hazardous wastes is required to register with DHES, Solid and Hazardous Waste Bureau, obtain an identification number, pay a sliding-scale fee based on the amount of waste generated annually, and renew the registration annually. A facility that produces 100 kilograms (approximately 220 pounds) or more of hazardous waste or 1 kilogram (approximately 2.2 pounds) or more of acute hazardous waste within any calendar month will be required to register and comply with all reporting and transporting rules. Anyone who purchases or uses 20 gallons or more of halogenous solvents in a year is also required to register with DHES.

Transporters of hazardous waste must obtain an identification number from DHES. Transporters who maintain offices, terminals, depots, or transfer facilities within Montana related to their hazardous waste transportation activities must register with DHES, Solid and Hazardous Waste Bureau.

Detailed reporting rules require hazardous waste producers to fill out manifest forms specifying the source, amount, and destination of the wastes. The transporter and the receiving hazardous waste management facility must sign and date the manifest to acknowledge receipt of the waste shipment. This process helps the waste producer ensure that the waste has

reached its destination at a properly licensed hazardous waste disposal site.

DHES has established procedures for dealing with problems that occur in the hazardous waste transportation and reporting process. DHES may, by rule, prescribe conditions under which specified hazardous wastes or specified quantities of hazardous wastes may be disposed of at disposal sites licensed by DHES.

The hazardous waste rules also include regulations related to leaking underground storage tanks. Facilities covered under these rules include, but are not limited to, (1) tanks used to contain a regulated substance of which 10 percent or more of the volume is beneath the surface of the ground, and (2) any underground pipes connected to a storage tank and used to contain or transport a regulated substance, whether the storage tank is entirely above ground, partially above ground, or entirely underground. An owner or operator of an underground storage tank who discovers or is provided evidence that the tank may have leaked must immediately notify DHES.

Any person who violates sections of the Montana Hazardous Waste Act, the related rules, or the terms of a Hazardous Waste Permit may be subject to civil or criminal penalties, which may include a fine or imprisonment.

Bioenergy producers are responsible for determining if any of their waste products or streams are hazardous wastes. They are also responsible for properly collecting, storing, recovering, or transporting the hazardous waste to a licensed disposal site. EPA has identified a number of hazardous wastes (40 CFR Sec. 261.10 to 261.33) that must be kept under control from their origin to their point of disposal.

Bioenergy facilities have the potential to generate hazardous wastes or waste streams that contain hazardous constituents, especially when they are not operating under ideal conditions. For instance, a municipal solid waste combustor that is not performing well can produce toxic substances such as hydrocarbons, creosote, and other organic compounds that result from incomplete combustion. These toxic substances should be captured by pollution control equipment and may need to be handled and disposed of as hazardous wastes.

Under certain operating conditions, developing bioenergy technologies such as gasification, liquefaction, and pyrolysis have the potential to produce wood tar containing creosote, benzopyrene, and phenol that are listed as hazardous wastes. Plants that produce regulated quantities of hazardous wastes should be designed and operated to produce the least possible hazardous waste. Plants that produce hazardous wastes under either normal operating conditions or less than ideal operating conditions must be registered with DHES as hazardous waste generators. DHES must be presented with a plan for properly collecting, handling, storing, and transporting the hazardous waste to a licensed disposal site, or a permit must be obtained to operate the facility as a hazardous waste management facility.

Commercial products used in bioenergy production, such as acids, bases, and solvents, can be classified as hazardous waste. Bioenergy products such as methanol, butanol, hydrocarbons, and diesel fuel substitutes are combustible and can be classified as hazardous wastes if they are spilled. Acid and base effluent streams will not be subject to hazardous waste control if they are properly handled and neutralized under carefully controlled conditions.

Bioenergy producers that use or produce commercial products that can be classified as hazardous wastes when discarded must register with DHES as producers of hazardous waste. These producers also must arrange for proper disposal of their wastes at a licensed disposal site. The registration and planning required will decrease the possibility of spilling or improper handling of hazardous waste.

WATER QUALITY

A permit from DHES, Water Quality Bureau is required to construct, modify, or operate a waste disposal system, or to construct or use any outlet for discharge of sewage, industrial wastes, or other wastes into state surface water or groundwater. Plans and specifications for tailings ponds, leaching pads, and holding facilities must be submitted to DHES for review and approval at least 180 days before the beginning of construction. An application for a MPDES Permit or a MGWPCS Permit must be filed no less than 180 days prior to the operation of a point source. Application information must include plans and specifications, site plans, descriptions of adjacent state waters, soil conditions, groundwater characteristics, process and waste flow diagrams, and volume and nature of projected discharges. Applications for a short-term exemption from water quality standards must be made on forms provided by DHES.

All discharges of pollutants authorized by a MPDES or MGWPCS Permit into state waters must be consistent with the conditions of the permit. The discharge of pollutants in excess of the permit's restrictions into state waters constitutes a violation of the permit. State waters must be free of discharges that (1) settle to form sludge deposits; (2) create floating debris; (3) produce odors; (4) create toxic concentrations harmful to human, animal, or plant life; or (5) create conditions capable of producing undesirable aquatic life. (See Water Quality, page 65.)

All bioenergy projects that discharge liquid or solid effluents into state surface water or groundwater must get a permit from DHES. No exceptions are made on the basis of the amount or concentration of the discharge. Bioenergy facilities are treated as point sources and are subject to state effluent standards applicable to such sources. EPA standards applicable to point sources are the least stringent standards for these sources. DHES, through the MPDES Permit process, can require application of stricter effluent standards to protect the state's water quality.

SECTION 4
PERMITS BY CATEGORY

INTRODUCTION

This section explains each permit in each permit category. Table 12 identifies the permit categories that might apply to each technology. If there is a question about whether a permit applies, contact the appropriate agency for more information. For example, collection and use of forest residues for combustion, cogeneration, densification, or alcohol production may require permits from the agency managing the forest. If a plant needs a well for water, a beneficial water use permit may be needed. The following descriptions of permits include procedures, costs, and some exceptions.

TABLE 12

PERMITS THAT MIGHT BE REQUIRED FOR BIOENERGY TECHNOLOGIES

	Agriculture	Air quality	Alcohol production	Building, mechanical, electrical, and plumbing permits	Forest clearing and burning	Highways/ transportation	Land use	Major facility siting	Occupational safety and health	Waste management	Water quality	Water use
Alcohol fermentation	•	•	•	•	•	•	•		•	•	•	•
Anaerobic digestion		•		•		•	•		•	•	•	•
Cogeneration		•		•	•	•	•	•	•	•	•	•
Densification		•		•	•	•	•		•	•	•	•
Direct combustion		•		•	•	•	•		•	•	•	•
Gasification		•		•	•	•	•	•	•	•	•	•
Landfill gas				•			•		•	•	•	•
Liquefaction		•		•	•	•	•	•	•	•	•	•
Oilseed extraction	•	•		•		•	•	•	•	•	•	•
Pyrolysis		•		•	•	•	•		•	•	•	•

Permit: COMMODITY DEALER'S LICENSE

Cost

Annual license fees per facility are based on volume of grain handled in the previous year or estimated yearly volume by hundredweight (cwt). Fees are:

1	- 25,000 cwt	$35.00
25,001	- 50,000	$60.00
50,001	- 125,000	$85.00
125,001	- 250,000	$110.00
250,001	- 375,000	$135.00
over	375,000	$160.00

An additional fee is required for each truck operated as a part of the business of being a commodity dealer. A bond or equivalent is required that needs to be equal to 2 percent of the value of the agricultural commodities purchased by the commodity dealer from the producer with a minimum bond or equivalent security of $20,000.

Law: *MCA* 80-4-601 et seq.

Rules: *ARM* 4.12.1012 et seq.

Contact: DOA, Plant Industry Division

Description

Any person who engages in a business involving or, as a part of his business, participates in buying, exchanging, negotiating, or soliciting the sale, resale, exchange, or transfer of any agricultural commodity in the state of Montana is a commodity dealer and must obtain a license from DOA before engaging in business in Montana.

Exceptions

The term, *commodity dealer*, does not apply to: (1) a person engaged in storing, shipping, or handling agricultural commodities who is being paid to store, ship, or handle agricultural commodities; (2) a person who buys agricultural commodities from a licensed commodity dealer or who does not purchase more than $30,000 worth of agricultural commodities from producers during a license year; (3) a person who is the producer of agricultural commodities that he actually plants, nurtures, and harvests; or (4) a person whose trading in agricultural commodities is limited to trading in commodity futures on recognized futures exchanges.

Procedures

Any person who wants to engage in the business of commodity dealer must apply to DOA for a license on forms provided by that department. The application must include the name of the applicant, the location of the principal places of business, a sufficient and valid bond, the number and description of trucks to be used to transport agricultural commodities, a financial statement, and any other information requested by the department. A license is issued annually and may be renewed by submitting all required licensing documents.

Permit: FEED DEALER'S PERMIT

Cost

The cost is $25.00 per calendar year for each facility, distribution point, or point of invoicing. Additional fees include a registration fee for each product other than a pet food.

Law: *MCA* 80-9-201 et seq.

Rules: *ARM* 4.12.201 et seq.

Contact: DOA, Plant Industry Division

Description

Coproducts, such as distillers' grains or oilseed meal manufactured for distribution or distrib-

uted as commercial feed in Montana, require a permit and registration with DOA.

Exceptions

A distributor who distributes only pet foods is exempt from this provision.

Procedures

A permit may be obtained by filing an application that includes the requestor's name, place of business, location of manufacturing facility, and distribution point or point of invoicing. Commercial feed that will be distributed in Montana must be registered with DOA and must comply with labeling format requirements, brand and product name specifications, expression of guarantee requirements, ingredient and directions for use statements, and other requirements as defined by the laws and rules. Inspection fees and annual statements are required.

Permit: WAREHOUSEMAN'S LICENSE

Cost

An annual license fee per warehouse is based on the volume of grain handled in hundredweight (cwt). Fees are:

0 - 25,000 cwt	$35.00
25,001 - 50,000	$60.00
50,001 - 125,000	$85.00
125,001 - 250,000	$110.00
250,001 - 375,000	$135.00
over 375,000	$160.00

Additional fees are required for each initial licensing inspection, amendment of a license, and maintaining an employee of DOA at a warehouse to supervise correction of a deficiency. A bond or equivalent based on the licensed capacity of the warehouse is required for each warehouse, with a minimum bond or equivalent security of $20,000.

Law: *MCA* 80-4-501 et seq.

Rules: *ARM* 4.12.1012 et seq.

Contact: DOA, Plant Industry Division

Description

Any person acting as a warehouseman and operating a public warehouse must obtain a license from DOA. A warehouse or public warehouse is an elevator, mill, warehouse, subterminal, grain warehouse, public warehouse, or other structure or facility in which, for compensation, agricultural commodities are received for storage, handling, processing, or shipment.

Exceptions: None

Procedures

Any person who wants to operate a warehouse must apply to DOA on forms provided by DOA. Upon application, a warehouseman must submit evidence of an effective insurance policy, a license fee, a current drawing showing storage facilities and capacity of the warehouse, a current financial statement, a sufficient and valid bond as determined by DOA, and a sample warehouse receipt. In addition, DOA must find each warehouse suitable for the proper storage of the agricultural commodities stored therein. DOA has detailed reporting and record-keeping requirements specified in the law.

AIR QUALITY

Permit: AIR QUALITY PERMIT

Cost

Although it currently does not do so, DHES may assess a fee from the applicant to cover the reasonable costs of reviewing and acting upon the application and to implement and enforce the terms and conditions of the air quality permit.

Law: Montana Clean Air Act, *MCA* 75-2-211, 212

Rules: *ARM* 16.8.1101 et seq.

Contact: DHES, Air Quality Bureau

Description

A permit is required for the construction, installation, and operation of equipment or facilities that may directly or indirectly cause or contribute to air pollution.

Exceptions

Exceptions listed in the rules include, but are not limited to: (1) residential heating units; (2) food service establishments; (3) any activity or equipment associated with the use of agricultural land or the planting, production, harvesting, or storage of agricultural crops (this exclusion does not apply to the processing of agricultural products by commercial businesses); (4) ventilating systems used in buildings that house animals; (5) road construction (except stationary sources); and (6) other sources that emit less than specified amounts. A complete list of exceptions is provided in *ARM* 16.8.1102.

Procedures

Appropriate permit application forms must be filed not later than 180 days before construction begins on any machine, equipment, device, or facility that may directly or indirectly cause or contribute to air pollution and not later than 120 days before installation, alteration, or use begins. The department requires permit applications to be accompanied by plans, specifications, and any other information necessary. DHES has 180 days from the receipt of the completed application to decide whether an application for a permit requires the compilation of an environmental impact statement (EIS). If an agency other than DHES is the lead agency in the EIS preparation, DHES must make a decision within 30 days after the issuance of the final EIS. When the department approves or denies the application for a permit, any person who is adversely affected may request a hearing under the provisions of the Montana Administrative Procedures Act.

Permit: OPEN BURNING PERMIT

Cost: None

Law: *MCA* 7-33-2205 and 76-13-121

Rules: *ARM* 26.6.301-304, 501-503 and 16.8.1301 et seq.

Contact: DHES, Air Quality Bureau

Description

Any person, institution, business, or industry conducting any open burning and qualifying as a major open burner is required to have an air quality open burning permit. Open burning means combustion of any material directly in the open air without a receptacle or in a receptacle other than a furnace, multiple-chambered incinerator, or wood-waste burner. Any major open burning source is one that will emit more than 500 tons per calendar year of carbon monoxide or 50 tons per calendar year of any other pollutant regulated by DHES except hydrocarbons. A minor open burning source refers to any open burning that is not a major open burning source.

A minor open burning source need not obtain a permit, but must comply with all rules, regulations, and special burning periods as stated in the rules. DHES requires use of BACT for all open burning. BACT for open burning may include, but is not limited to: (1) scheduling burning during periods and seasons of good ventilation, (2) applying dispersion forecasts, (3) limiting the amount of burning during any one time period, and (4) promoting alternative treatments and uses of materials to be burned. Materials that may not be disposed of by open burning are specified in the rules. The recognized fire protection agency for the area (county, state, or U.S. Forest Service) may also require a burning permit or may have special requirements or established time periods for burning.

Exceptions

Exceptions are small recreational fires, construction site heating devices used to warm workers, and safety flares used to dispose of dangerous gases at refineries, gas sweetening plants, and oil or gas wells.

Procedures

Prior to major open burning, an application must be submitted on forms provided by DHES. The application must contain a legal description or a detailed map of each planned site of open burning, the elevation of each planned site, the method of burning to be used, and the average fuel loading or total fuel loading at each site to be burned. Permits are issued for one year. Conditional air quality open burning permits may be issued on a temporary basis for special categories of open burning of wood, wood by-product trade waste, and untreated waste wood at licensed landfill sites that meet specific requirements stated in the rules. Emergency open burning permits may be issued to allow burning of a substance not otherwise approved for burning if the applicant demonstrates that the substance poses an immediate threat to public health and safety, or plant and animal life, and that no alternative method of disposal is available.

Permit: PREVENTION OF SIGNIFICANT DETERIORATION (PSD) REVIEW

Cost

The applicant may be assessed a fee to implement and enforce the terms and conditions of the air quality permit.

Law: Montana Clean Air Act, *MCA* 75-5-211

Rules: *ARM* 16.8.921 et seq.

Contact: DHES, Air Quality Bureau

Description

When a major stationary source or major modification of a stationary source of air pollution is proposed in an area where ambient air quality is better than the applicable standards, a more stringent review procedure may apply. PSD standards apply to all areas that meet ambient air quality standards. A major stationary source is: (1) any source that will emit more than 250 tons per year of any pollutant, or (2) certain named source categories that will emit more than 100 tons per year of any pollutant.

Exceptions

PSD standards do not apply in areas not currently in compliance with national ambient air standards (nonattainment areas).

Procedures

DHES conducts a PSD review during the processing of all applications for air pollution permits if air quality in the affected area is better than required by applicable standards. If conditions are such that PSD standards apply, DHES may require one year of pre-application baseline data. BACT compliance will be required for all sources that require a permit.

ALCOHOL PRODUCTION

Permit: ALCOHOL FUEL PRODUCER'S PERMIT

Cost

Bonds are required; the amounts are related to plant size.

Law: 26 *USC* 5181

Rules: 27 *CFR* 19.901 et seq.

Contact: U.S. Bureau of Alcohol, Tobacco, and Firearms (BATF), San Francisco Office

Description

BATF of the U.S. Department of the Treasury administers federal laws and regulations concerning taxation, production, and distribution of alcohol. Federal laws require that every producer of ethyl alcohol properly qualify the plant and obtain a permit before beginning operation.

Exceptions

Plants producing fewer than 10,000 gallons per year do not require a bond.

Procedures

Request an information packet and application forms from the San Francisco office of BATF. The application may need to include, but may not be limited to: (1) information on the size of the plant, (2) site diagrams, (3) lists of feedstocks, (4) description of stills and security, and (5) statements regarding environmental impacts. Submit the completed application and bond, if applicable, to BATF, which has 60 days to approve or respond to the application. The bonding fee must be submitted and approved before a permit can be issued. BATF has detailed reporting requirements on production, use, and distribution of alcohol. These requirements vary depending on the size of the plant. Permits remain in effect as long as the permit holder complies with laws and regulations.

Permit: ALCOHOL DISTRIBUTOR'S LICENSE

Cost: None

Law: *MCA* 15-70-501 et seq.

Rules: *ARM* 47-27-601 et seq.

Contact: DOT, Motor Fuels Tax Division, Accounting Services Bureau, Gasoline Unit

Description

Prior to doing business in Montana, every alcohol distributor must obtain an Alcohol Distributor's License.

Exceptions: None

Procedures

Request application forms from DOT. Upon approval of the application, DOT issues a nonassignable license that continues in force until surrendered or canceled. After obtaining a license, a distributor is required to file monthly statements that include the number of gallons of alcohol manufactured or imported by the distributor, the name of the gasohol dealer to whom the alcohol is sold and number of gallons sold to each dealer, and any other information required by DOT. The information on these forms qualifies the distributor for a tax incentive on each gallon of ethyl alcohol produced, provided the alcohol was produced in Montana from Montana products, including Montana wood or wood products, and provided the alcohol was blended with gasoline for sale as gasohol or was exported from Montana and was blended with gasoline for sale as gasohol. DOT has detailed record-keeping requirements and may request examination of any records within three years after they are recorded.

BUILDING, MECHANICAL, ELECTRICAL, AND PLUMBING PERMITS

Permit: BUILDING PERMIT

Cost

The permit fee is based on the valuation of all construction work for which the permit is issued, using the cost-per-square-foot method of valuation and cost-per-square-foot figures for the type and quality of construction.

Law: *MCA* 50-60-101 et seq.

Rules: *ARM* 8.70.101 et seq.

Contact: DOC, Building Codes Bureau or local building department

Description

All construction throughout the state must comply with the state building codes and permit regulations. If towns and counties have adopted local building codes, then enforcement is by local rather than state authorities. Local authorities must adopt the same standards enforced by the state, but may extend their jurisdiction up to 4 ½ miles outside the city limits, and may establish their own fee schedule. All areas not regulated by the local authority will be under the jurisdiction of the state.

Exceptions

Detailed lists of exceptions are outlined in the rules, but they may not be applicable if the town or county has adopted local building codes. Exceptions to state rules include residential buildings containing fewer than five dwelling units, private garages or storage structures used only by the owner, farm and ranch buildings, and mining buildings on mine property.

Procedures

Contact either the local building department or the state DOC to determine which has jurisdiction in your area. Either agency may require detailed plans and information on a project and an on-site inspection prior to issuing a permit. With some exceptions, the state and local building departments have adopted the standards from the *Uniform Building Code, 1988.*

Permit: MECHANICAL PERMIT

Cost

A fee schedule is listed in the rules.

Law: *MCA* 50-60-101 et seq.

Rules: *ARM* 8.70.105 et seq.

Contact: DOC, Building Codes Bureau or local building department

Description

A mechanical permit is required for the design, construction, installation, operation, and maintenance of heating, ventilating, cooling, or refrigeration systems; incinerators; and other miscellaneous heating appliances. The mechanical permit also specifies the quality of materials and site considerations. The local building department may administer its own program instead of the state program if it is certified to do so.

Exceptions

Changes and additions to the *Uniform Mechanical Code, 1988* are listed in the rules.

Procedures

Contact either the local building department or the state DOC to determine which has jurisdiction in your area. Either agency may require both detailed plans and information on a project as well as an on-site inspection before it will issue a permit. With some exceptions, the state and local building departments have adopted the standards from the *Uniform Mechanical Code, 1988.*

Permit: ELECTRICAL PERMIT

Cost

A fee schedule is listed in the rules.

Law: *MCA* 50-60-601 et seq.

Rules: *ARM* 8.70.401 et seq.

Contact: DOC, Building Codes Bureau or local building department

Description

An electrical permit is required for any electrical installation in any new construction or remodeling. The local building department may administer an enforcement program in lieu of the state program if it is certified to do so.

Exceptions

Electrical permits are not required for installation, alteration, or repair of electrical signal or communications equipment owned or operated by a public utility or a city. Inspection provisions do not apply to work done by regularly employed maintenance electricians on the business premises of their employers. These provisions also do not apply to line work on the business premises of the employer or to ordinary and customary in-plant or on-site installations, modifications, or repairs.

Procedures

Contact either the local building department or DOC to determine which has jurisdiction in your area. Either agency may require detailed plans and information on a project as well as an on-site inspection prior to issuing a permit. With some exceptions, the state and local building departments have adopted the standards from the *National Electrical Code, 1990.*

Permit: PLUMBING PERMIT

Cost

A fee schedule is listed in the rules.

Law: *MCA* 50-60-501 et seq.

Rules: *ARM* 8.70.301 et seq.

Contact: DOC, Building Codes Bureau or local building department

Description

A plumbing permit is required for the installation, removal, alteration, or repair of plumbing and drainage systems and parts of systems for all commercial and public facilities. The local building department may administer an enforcement program instead of the state program, if it is certified to do so.

Exceptions

The following exceptions apply. (1) Plumbing permits do not affect or apply to plumbing installations in any mines, mills, smelters, refineries, public utilities, or railroads, or plumbing installations on farms. (2) Permits are not required for repair work. (3) The owner of a residential property can install the plumbing without a permit if he does the work himself. (4) Plumbing permits are not required for regularly employed maintenance personnel doing maintenance work on the business premises of their employer.

Procedures

Contact either the local building department or DOC to determine which has jurisdiction in your area. Either agency may require both detailed plans and information on a project and an on-site inspection before issuing a permit. With some exceptions the state and local building departments have adopted the standards from the *Uniform Plumbing Code, 1988.*

FOREST CLEARING AND BURNING

Permit: FIRE HAZARD REDUCTION/ CERTIFICATE OF CLEARANCE

Cost

The application fee is $25.00 plus an additional fee based on the number of board feet cut. A bond must be posted.

Law: *MCA* 76-13-401-414

Rules: *ARM* 26.6.501-503

Contact: DSL, Forestry Division

Description

A permit is required for slash disposal, timber cutting, or timber stand improvements on private lands or right-of-way clearing by public or private utilities.

Exceptions: None

Procedures

DSL must be notified at least 10 days before right-of-way is cleared. DSL requires executing a fire hazard reduction agreement and posting a bond before a certificate of clearance may be issued.

Permit: TIMBER REMOVAL PERMIT

Cost

Fees are set by the Board of Land Commissioners. Check with DSL regarding the required fees.

Law: *MCA* 7-8-2608-2609, 77-5-211-213

Rules: *ARM* 26.6.401 et seq.

Contact: DSL, Forestry Division or Board of County Commissioners

Description

Permits for the removal of dead or inferior timber from state forests are required by DSL or by the board of county commissioners for county forests. Permits may be issued on state or county forests to use dead or inferior timber for fuel or domestic purposes. Permits also may be issued without advertising to citizens of Montana for commercial timber harvest at commercial rates on state forests in quantities of less than 100,000 board feet, or in cases of emergency. Farmers, ranchers, and prospectors may obtain permits to purchase timber in state forests in quantities not to exceed 25,000 board feet for repair and development on a farm, ranch, or mine.

Exceptions

In the case of a timber salvage emergency, permits also may be issued to citizens of Montana without advertising for less than 200,000 board feet of timber in state or county forests.

Procedures

Contact DSL for permit application forms and details regarding fees.

Permit: FLOODPLAIN DEVELOPMENT PERMIT

Cost

The fee charged by local government varies.

Law: *MCA* 76-5-101-405

Rules: *ARM* 36.15.101-903

Contact: DNRC, Water Resources Division, Engineering Bureau or local government

Description

A permit is necessary for any improvement, alteration, or placement of an artificial obstruction in a designated floodplain or floodway. If local governments do not adopt floodplain management regulations, DNRC is required to enforce the standards adopted by the Board of Natural Resources and Conservation.

Exceptions

Open space uses that do not require structures, fill, or storage are allowable without permits. Examples include grazing, growing crops, parking and loading areas, and forestry.

Procedures

Local government or DNRC can be contacted to determine which has jurisdiction over the prospective location. A permit application is automatically granted 60 days after receipt of the application, unless the applicant has been notified that the permit has been denied or that there will be a delay. If the proposed project is determined to have a significant impact on the environment, DNRC may require the applicant to provide information and funding necessary for the preparation of an environmental impact statement (EIS). After the EIS process, the time required for review of a permit application will be from 60 to 120 days.

Permit: LAKESHORE DEVELOPMENT PERMIT

Cost: $10.00

Law: MCA 75-7-201 et seq.

Rules: As adopted by local governments

Contact: Local government

Description

If a local government has adopted lakeshore protection regulations, a permit is required for any work that will alter the course, current, or cross-sectional area of a navigable lake or its shore. Such activities include construction of channels and ditches; dredging of lake bottom areas to remove muck, silt, or weeds; lagooning; filling; or constructing breakwaters, wharves, or docks. Upon petition from adjacent landowners, DNRC may adopt and enforce regulations.

Exceptions

A permit is not required in areas that have not adopted local regulations, unless adjacent landowners petition DNRC to adopt and enforce regulations.

Procedures

Contact the local government to see if local regulations have been adopted regarding lakeshore protection. Specific regulations and requirements may vary. Unless the applicant agrees to an extension of time, the governing body must grant or deny permission for the permit within 90 days of receiving an application. Variances may be granted, but require a public hearing and preparation of an environmental impact statement (EIS) at the expense of the applicant. A person who performs work in a lake without the necessary permit may be required to restore the lake to its previous condition.

MAJOR FACILITY SITING

Permit: CERTIFICATE OF PUBLIC NEED AND ENVIRONMENTAL COMPATIBILITY

Cost

A fee schedule based on the cost of the proposed project is in the law.

Law: Major Facility Siting Act, *MCA* 75-20-101 et seq.

Rules: Each agency adopts its own set of rules.

Contact: DNRC, Facility Siting Bureau and DHES, Air Quality Bureau and Water Quality Bureau

Description

A Certificate of Public Need and Environmental Compatibility may be required from the Board of Natural Resources and Conservation for major facilities that generate or transmit electricity, produce gas from coal or liquid hydrocarbon products or transmit them by pipeline, enrich uranium minerals, use or convert coal, or use geothermal resources. Transportation links, aqueducts, dams, transmission substations, and other facilities associated with the production or delivery of energy from covered facilities are included. The certificate will be required if the proposed development constitutes a "major facility" as defined under the act. A major facility is: (1) any facility designed to generate 50 megawatts or more of electricity; (2) any addition to a facility having an estimated cost in excess of $10 million; (3) a facility producing 25 million cubic feet or more per day of gas derived from coal, or any addition having an estimated cost of over $10 million; or (4) a plant producing 25,000 barrels of liquid hydrocarbon products or more per day, or any addition to such a plant having an estimated cost of over $10 million. Federally owned or controlled facilities must satisfy the substantive criteria of the Major Facility Siting Act. Certification is also required from DHES to ensure that the facility will not violate air or water quality standards or other laws administered by DHES.

Exceptions

Excluded are crude oil and natural gas refineries; facilities for producing, gathering, transporting, and distributing crude oil and natural gas; facilities subject to the Montana Strip and Underground Mine Reclamation Act; and federal facilities under the jurisdiction of the federal government.

Procedures

An applicant for a certificate under the Major Facility Siting Act must file a joint application with DNRC and DHES. The application will include information on need for the facility, the proposed location, alternative sites, baseline data, and other information defined in the law. The applicant must submit an original and 19 copies of the application to DNRC and send copies to other state agencies listed in the law. Time requirements for the application process are listed in the law.

OCCUPATIONAL SAFETY AND HEALTH

Permit: BOILER OPERATING CERTIFICATE

Cost: No charge

Law: *MCA* 50-74-101 et seq.

Rules: *ARM* 24.30.701 et seq.

Contact: DOLI, Safety Bureau

Description

All boilers must be licensed by DOLI. All boilers installed and operated in Montana must follow the rules for safe construction, installation, operation, inspection, and repair of equipment as stated by DOLI. The definitions and rules follow nationwide engineering standards as published by the American Society of Mechanical Engineers (ASME).

Exceptions

Exceptions listed in the rules are: (1) boilers under federal control, (2) steam heating boilers operated at 15 pounds per square inch (psi) or less in private residences or apartments of six or fewer families, and (3) water heating or supply boilers operated at not over 50 psi gauge pressure and temperatures not over 250 degrees F in private residences or apartments of six or fewer families. Hot water supply boilers are exempt from inspections if they do not exceed any of the following: heat input of 400,000 Btus per hour, water temperatures of 210 degrees F, or nominal water-containing capacity of 120 gallons. However, such hot water supply boilers still must be equipped with safety devices.

Procedures

Within 10 days after purchase of any boiler, either traction or stationary, not specifically exempted by law, the purchaser must report the purchase to DOLI. DOLI must also be told where the boiler will be installed and operated. Regular inspections are required by DOLI. Within 90 days of the installation, all new boilers must be stamped with the serial number given by DOLI. Boiler operating certificates are issued annually after an on-site inspection of the boiler. Used boilers must also be inspected and assigned a serial number.

Permit: BOILER OPERATOR'S LICENSE

Cost:	$30.00	First-Class License
	$20.00	Second-Class License
	$12.00	Third-Class License
	$8.00	Low-Pressure License
	$4.00	License Renewal

Law: *MCA* 50-74-301 et seq.

Rules: None

Contact: DOLI, Safety Bureau

Description

Persons operating all boilers and steam engines covered by state law are required to hold the proper grade of license. To obtain a license a person must meet qualifications for licensing as detailed in the law and pass an examination. The four classes of engineers are first-class, second-class, third-class, and low-pressure engineers.

Exceptions

Exceptions to the minimum qualification requirement for all classes of engineers are detailed in the law. For more information, contact DOLI, Safety Bureau.

Procedures

An applicant must pass a written examination and meet other requirements as stated in the law. Licenses must be renewed annually.

Permit: FIRE SAFETY INSPECTIONS

Cost

The state does not have a fee, but local fire authorities with their own enforcement programs may require a fee.

Law: *MCA* 50-61-101 et seq.

Rules: *ARM* 23.7.101 et seq.

Contact: Department of Justice (DOJ), State Fire Marshall; Municipal Fire Chief; or County Sheriff

Description

Buildings designed for assembly, business, education, or industrial, institutional, or residential occupancy (other than single-family private homes) must meet fire escape, fire alarm, and fire extinguisher requirements. Industrial occupancy includes, but is not limited to, mills, power plants, and processing plants. Local fire authorities may have their own enforcement program, may require a permit, or may have adopted a fee schedule.

Exceptions: None

Procedures

Contact the local fire authority or DOJ to see who has jurisdiction in your area. Both require compliance with the *Uniform Fire Code, 1985* and may require inspections. Local fire authorities may require permits or a fee. Fire extinguishers must be checked and maintained at regular intervals.

WASTE MANAGEMENT

Permit: HAZARDOUS WASTE MANAGEMENT FACILITY PERMIT

Cost

The fee is set on a sliding scale based on the complexity of the proposed operation.

Law: Montana Hazardous Waste Act, *MCA* 75-10-401 et seq.

Rules: *ARM* 16.14.101 et seq.

Contact: DHES, Solid and Hazardous Waste Bureau

Description

A permit is necessary to construct or operate a hazardous waste management facility. A hazardous waste is a waste or combination of wastes that, because of quantity, concentration, or physical, chemical, or infectious characteristics, may kill people or make them seriously ill, or pose a substantial hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous wastes include, but are not limited to those that are toxic, radioactive, corrosive, or flammable; contain irritants or strong sensitizers; or generate pressure through decomposition, heat, or other means. A hazardous waste management facility means all contiguous land, structures, and improvements on the land used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units. Special requirements for hazardous waste generated by small quantity generators can be found in the rules in *ARM* 16.44.402.

Exceptions

Large- and small-scale producers of hazardous waste, as defined in *ARM* 16.44.401, who store hazardous waste on-site in compliance with accumulation time limits, as specified in *ARM* 16.44.415, are not required to obtain a hazardous waste management permit. Other exclusions are listed in *ARM* 16.44.103. A producer or transporter of hazardous wastes or an owner or operator of a hazardous waste management facility may apply to the Board of Health and Environmental Sciences (BHES) for a variance from any requirement in the laws or rules. The law states various conditions under which BHES may grant a variance.

Procedures

Any person wanting to construct or operate a hazardous waste management facility must apply to DHES for a permit on forms provided by DHES. An application must contain, at a minimum, the name and business address of the applicant, up to four Standard Industrial Classification (SIC) codes that best reflect the principal products or services provided by the facility, the location of the proposed facility, a plan of operation and maintenance, a list of permits received or applied for, and a description of pertinent site characteristics. A permit is effective for a fixed term not to exceed 10 years and is subject to either renewal or revocation, depending on compliance with the permit's provisions. Permit conditions are established by DHES on a case-by-case basis. DHES may require detailed monitoring, record-keeping, and reporting as conditions of the permit. An environmental assessment (EA) may be part of the application review process. If indicated by the EA, an environmental impact statement may be required before a permit can be issued. Decisions may be appealed under the conditions of the Montana Administrative Procedures Act.

Permit: SOLID WASTE MANAGEMENT SYSTEM LICENSE

Cost: None

Law: Montana Solid Waste Management Act, *MCA* 75-10-201 et seq.

Rules: *ARM* 16.14.501 et seq.

Contact: DHES, Solid and Hazardous Waste Bureau

Description

DHES requires a license for the disposal of solid waste and for the operation of a solid waste management facility.

Exceptions

A possible exception may apply for a person who owns or leases more than 5 acres of land that is not within a subdivision. Under certain conditions, that person may dispose of his own solid waste that is generated in reasonable association with his household or agricultural operations on his own land as long as the disposal does not create a nuisance or public health hazard.

Procedures

Any person who wants to establish and operate a solid waste management system facility must apply to DHES for a permit on forms provided by DHES. An application must contain, at a minimum, the name and business address of the applicant, the location of the proposed facility, a plan of operation and maintenance, and a description of pertinent site characteristics. If additional information is needed, DHES will inform the applicant and postpone processing the application. If the requested additional information is not received within 90 days after the applicant has been notified, a new application

must be submitted. Within 15 days after receipt of the completed application, DHES must notify the local health officer in the county where the proposed system would be located. After DHES issues a proposed decision, it must comply with public notice regulations as stated in the rules. DHES also conducts an environmental assessment (EA). After a 30-day period for the public to comment on the EA, DHES must decide whether to issue the license or require an environmental impact statement. An appeals process is described in the rules.

WATER QUALITY

Permit: MONTANA GROUNDWATER POLLUTION CONTROL SYSTEM (MGWPCS) PERMIT

Cost: None

Law: Montana Water Quality Act, *MCA* 75-5-101 et seq.

Rules: *ARM* 16.20.1001 et seq.

Contact: DHES, Water Quality Bureau

Description

Any person who wants to discharge pollutants into state groundwater must obtain an MGWPCS permit. Groundwater classifications are established to protect water for beneficial uses. DHES has a policy of not allowing degradation of groundwater. High quality groundwater must be maintained at that quality unless it has been positively demonstrated that a change is justifiable for necessary economic or social development and will not preclude present or anticipated uses of such waters.

Exceptions

Exclusions listed in the rules include, but are not limited to, solid waste management systems and hazardous waste management systems licensed by DHES, discharges or activities regulated under the federal underground injection control (UIC) program, persons disposing of their own household waste on their own property, and agricultural irrigation projects.

Procedures

An application for an MGWPCS permit must be filed at least 180 days prior to beginning operation. All applications must be submitted on forms that are obtained from DHES and must contain a site plan, location of treatment works and disposal system, list of people who own or lease adjacent land, location of adjacent state surface waters, location of water supply wells and springs within 1 mile, description of waste or process solutions, information on existing groundwater quality, and any additional information DHES may require. DHES will determine if the application is complete within 30 days.

Upon receipt of a completed application, DHES must make a preliminary determination of whether a permit should be issued. DHES is then required to issue a public notice regarding the proposed discharge and the preliminary determination. At least 30 days must be provided for a public comment period. The applicant, any affected agency, the regional administrator of EPA, or any interested person may submit a written request for a hearing. A hearing will be held if DHES determines there is good cause or sufficient interest to hold a hearing. DHES will provide a 30-day public notice of the hearing. If a hearing is not held, DHES must make a final decision on permit issuance within 30 days. If a public hearing is held, DHES must make a decision within 60 days following the hearing.

The conditions of the permit may include proposed discharge limitations and conditions; monitoring and reporting requirements, if any; necessary schedules of compliance, including interim dates and requirements for meeting proposed discharge limitations; or other special conditions. A permittee must request reissuance of the permit at least 90 days prior to its date of expiration. Operators who have submitted permit applications for groundwater discharge sources under the MPDES permit program will be deemed to have complied with the application requirements for this permit.

Permit: MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM (MPDES) PERMIT

Cost: None

Law: Montana Water Quality Act, *MCA* 75-5-101 et seq.

Rules: *ARM* 16.20.1301 et seq.

Contact: DHES, Water Quality Bureau

Description

A permit from DHES is required to construct, modify, or operate a disposal system or to construct or use any outlet for the discharge of sewage, industrial wastes, or other wastes into state surface waters. The MPDES permit regulates the discharges of pollutants from point sources into state waters. A point source can be any discernible conveyance, such as a pipe, a ditch, or a floating craft, from which pollutants are discharged. An animal confinement facility may also be a point source. All discharges of pollutants into state waters authorized by an MPDES permit must be consistent with the conditions of the permit. If there is a violation of the permit, DHES may modify, suspend, or revoke the permit. DHES has a nondegradation policy that requires that any state water of a quality higher than the established water quality standards be maintained at that high quality. Permits may require effluent limitations or other conditions on industrial, public, or private projects or developments that constitute a new or an increased source of pollution to high quality waters.

Exceptions

Federal permitting authority is involved for activities on Indian reservations. For more information, see the discussion on the National Pollutant Discharge Elimination System (NPDES) permit later in this section.

Procedures

The application for an MPDES permit must be filed no less than 180 days prior to the operation of a point source. Application information required by DHES includes, but is not limited to, plans and specifications, site descriptions, process and waste flow diagrams, and volume and nature of projected discharges. Upon receipt of a completed application, DHES must make a preliminary determination with respect to issuance or denial of a permit. DHES is then required to issue public notice and allow 30 days for public comment. If DHES denies the discharge permit, a hearing may be requested. All permits are issued for a fixed term not to exceed five years.

Permit: NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT

Cost: None

Law: Water Pollution Control Act, 33 *USC* 1251 et seq.

Rules: 40 *CFR* 122 et seq.

Contact: EPA

Description

Anyone who wants to discharge wastewater on Indian reservations must obtain an NPDES permit and comply with minimum discharge limits established by EPA. A permit also is required to modify or expand a project.

Exceptions

Activities in incorporated municipalities on Indian reservations are excluded.

Procedures

Any person who wants to discharge wastewater on an Indian reservation must apply to EPA on forms provided by that agency. After a completed application has been received, EPA drafts either the permit or the denial and publishes the notice of intent to issue or deny. There is a 30-day comment period, and then the agency must issue a denial or approval. EPA may include effluent limitations and monitoring and reporting requirements as conditions of the permit. A permit is issued for a fixed term up to five years. The applicant must apply for renewal of the permit 180 days before its expiration date.

Permit: STREAM PROTECTION ACT PERMIT

Cost: None

Law: *MCA* 87-5-501 et seq.

Rules: None

Contact: Department of Fish, Wildlife and Parks (DFWP), Fisheries Division

Description

A state or local government agency must obtain a permit before engaging in a project that may change the existing shape or form of any stream.

Exceptions

This law does not apply to any irrigation district project or any other irrigation system. In addition, it does not apply during an emergency. For a determination of what constitutes an emergency, contact DFWP, Fisheries Division.

Procedures

Within 30 days after receipt of project plans, DFWP must notify the applicant whether the project would adversely affect fish or wildlife habitat or issue a permit. DFWP may require modifications to the proposed project plans. If an agreement cannot be reached, an arbitration panel may be appointed by the district court.

Permit: STREAMBED AND LAND PRESERVATION PERMIT (310 PERMIT)

Cost: None

Law: Natural Streambed and Land Preservation Act, *MCA* 75-7-101 et seq.

Rules: *ARM* 36-2-401 et seq.

Contact: Conservation district supervisors or DNRC, Conservation Districts Bureau

Description

Any private, nongovernmental individual or corporation that proposes to work in or near a stream on private or public land must apply for a 310 permit.

Exceptions: None

Procedures

The person conducting the work should submit a completed application to the conservation district office. At their next monthly meeting, district supervisors will determine whether the planned activity requires a 310 permit. Following a team inspection, the district supervisors will approve, modify, or deny the permit application. The permit process takes approximately 60 days or more. The supervisors may extend the time limits up to one year when necessary. If an agreement cannot be reached, an arbitration panel may be appointed by the district court. Detailed procedures for times of emergency are listed in the conservation district rules and in the law (MCA 75-7-113).

WATER USE

Permit: BENEFICIAL WATER USE PERMIT

Cost

A sliding-scale fee schedule based on volume of water is listed in the rules. Refer to the rules for required fees.

Law: Montana Water Use Act, *MCA* 85-2-301 et seq.

Rules: *ARM* 36.12.101 et seq.

Contact: DNRC, Water Rights Bureau

Description

A Beneficial Water Use Permit is required to appropriate either surface water or more than 35 gallons per minute or 10 acre-feet per year of groundwater. This permit is required for uses that benefit the appropriator, other persons, or the public. Examples of beneficial uses are agriculture, including stockwater; domestic; fish and wildlife; industrial; irrigation; mining; municipal; power; and recreation. With some exceptions, a person who intends to appropriate water for a reservoir also needs a permit. In order to protect all water rights, any proposed changes in an existing water permit must be approved by DNRC. Such changes might include change in kind of use or location of use, diversion, or storage.

Exceptions

The following exceptions apply. (1) A permit is not required prior to construction of a reservoir or pit to be used for watering livestock if the pit or reservoir meets certain conditions. If the pit or reservoir will be filled with water from a nonperennial stream, hold less than 15 acre-feet of water, and be located on a piece of land larger than 40 acres, construction can begin immediately. Within 60 days of completion, an application for a Stockwater Provisional Permit must be submitted to DNRC. A provisional permit subject to prior water rights will be issued. If the reservoir has adverse effects on prior rights, DNRC can require modifications to the reservoir or revoke the permit. (2) Outside of a controlled groundwater area, a permit is not required to appropriate water by means of a well or developed spring with a maximum appropriation of 35 gallons per minute or less, not to exceed 10 acre-feet per year. Within 60 days after a well is completed, the driller must file with DNRC a log report on a form provided by the department. Within 60 days after the water has been put to beneficial use, the well owner must file a Notice of Completion of Groundwater Development with DNRC.

Procedures

Any person who wants to appropriate groundwater or surface water by building a diversion, impoundment, or withdrawal or distribution works must apply for a permit on forms provided by DNRC. Upon receipt of a completed application, DNRC is required to publish public notices pertinent to that application. DNRC must grant, deny, or condition an application for a permit in whole or in part within 120 days after the last date of publication of notice of application if no objections have been received, or within 180 days if a hearing is held or objections have been received. DNRC may issue a permit subject to any terms, conditions, restrictions, and limitations it considers necessary to protect the rights of other appropriators. For more information, consult any of DNRC's field offices in Billings, Bozeman, Glasgow, Havre, Helena, Kalispell, Lewistown, Miles City, and Missoula. Addresses for these offices are included in Appendix B.

SECTION 5
SPECIAL CONSIDERATIONS

BUSINESS LICENSING REQUIREMENTS

A bioenergy project must comply with a wide variety of laws and rules and must obtain a number of permits and licenses to do business in Montana. A business owner must file with the Secretary of State for any of the following that are applicable to the business: a certificate of partnership, articles of incorporation, registration of an assumed business name, or registration of a trademark. Other business responsibilities may include obtaining a local business license, obtaining a federal tax identification number, registering with the state DOR as an employer for income tax purposes, filing a state withholding tax registration, registering for unemployment insurance, or obtaining worker's compensation insurance.

The Business Licensing Center of DOC, Business Development Division has a toll-free number and produces the *Montana Business Licensing Handbook*, which offers a brief summary of many of the business licenses and permits required by the state, and *Guide to Montana's Economic Development and Business Development Programs*. See Appendix B for the toll-free number and the selected bibliography for a complete citation for the publications.

COGENERATION AND SMALL POWER PRODUCTION

A cogeneration or small power production facility must be certified as a qualifying facility (QF) to operate in Montana and receive a rate based on the provided cost of power. A QF must meet certain requirements as stated in Montana law, MCA 69-3-601. Those requirements state that the facility must: (1) produce electricity as a primary energy source from biomass, waste, water, wind, or other renewable resource or any combination of those resources; or (2) produce electricity and useful forms of thermal energy, such as heat or steam, used for industrial or commercial heating or cooling purposes through the sequential use of energy known as cogeneration; and (3) have a power production capacity that, together with any other facilities located at the same site, is not greater than 80 megawatts; and 4) be owned by a person not primarily engaged in the generation or sale of electricity other than electric power from a small power production facility.

FERC controls the certification process for a QF. There are two ways to obtain certification. The first option is self-qualification, which is accomplished by notifying FERC of the existence of the facility and supplying other information

required by the agency. While this method has less paperwork, takes less time, and does not require a fee, the disadvantage is that the certification may be challenged. Later delays and economic problems can result. The alternative is to apply to FERC for certification. Detailed facility information as listed in 18 CFR 292.207 and a filing fee must accompany the application. For more information on the certification processes, call or write FERC in Washington, D.C., at the address listed in Appendix B.

Facilities that are connecting to a utility can get guidelines from that utility. Facilities also must comply with state electrical standards, apply for an electrical permit, and be inspected by state inspectors prior to initiating service.

The PSC determines rates and conditions of those rates for contracts between cogenerators and small power producers and the following utilities: Montana-Dakota Utilities Company, Montana Power Company, and Pacific Power and Light Company. Various types of contract agreements can be negotiated with these utilities. For more information, contact the appropriate utility:

Gary Paulsen, System Operations
Montana-Dakota Utilities Company
400 North Fourth Street
Bismarck, ND 58501 701-222-7649

Robert Stuart, Director of Power Contracts
Montana Power Company
40 East Broadway
Butte, MT 59701 723-5421

Dennis Wedam, Area Engineer
Pacific Power and Light Company
448 Main Street
Kalispell, MT 59901 752-7461

Utilities owned or controlled by a municipality, town, county, or city-county water or sewer district are excluded from PSC jurisdiction. Rates and services for such systems are determined by the local governing body or district.

Facilities located in a district served by a private company or an electric cooperative negotiate rates and contracts directly with that cooperative. More information on electric cooperatives in Montana is available from the Montana Electric Cooperative Association. See Appendix B for its address and the addresses of all electric cooperatives in Montana.

Cogeneration facilities that produce electricity may be liable to pay an electrical energy producer's license tax. Montana law states that each person or organization engaged in the generation, manufacture, or production of electricity and electric energy for barter, sale, or exchange must pay an electrical energy producer's tax of $.0002 per kilowatt-hour. For information, contact DOR, Natural Resource and Corporation Tax Division.

DAM SAFETY

The Dam Safety Act (MCA 85-15-101-502) requires construction and operating permits for high-hazard dams. A high-hazard dam is a dam that impounds 50 acre-feet or more of water and would likely cause a loss of life if it fails. DNRC, Water Resources Division administers this program; issues permits; establishes safety standards for the design, construction, operation, and maintenance of high-hazard dams; conducts periodic inspections; establishes fees commensurate with recovering inspection costs; and provides copies of the law and administrative rules (ARM 36.14.101 et seq.) on request.

FORESTED AREAS

Requirements regarding harvesting of timber and removal of slash and wood waste for commercial uses vary depending on land ownership. Boards of county commissioners; DSL, Forestry Division; USFS; and BLM all administer forest lands in Montana.

A permit is required from DSL for slash disposal on private or state lands. A permit is also required from DSL for timber cutting or timber stand improvement on state lands, and for right-of-way clearing by public or private utilities. Permits may be issued to county residents to use dead or inferior timber for fuel or domestic purposes. Farmers, ranchers, and prospectors may also obtain permits for timber removal from state forest land in quantities not to exceed 25,000 board feet for domestic purposes in the repair and development of a farm, ranch, or mine. Permits may be issued to Montana citizens for commercial purposes at commercial rates without advertising for timber in state forests in quantities of less than 100,000 board feet or in emergency cases due to fire, insects, or blowdown. (See Forest Clearing and Burning, page 59.) For more information, contact DSL or any of its field offices at the addresses listed in Appendix B.

Timber sales on federal lands administered by BLM and USFS are advertised for competitive bids. BLM may negotiate individually with purchasers for small amounts of timber in special instances. For more information, contact each national forest office or each office of BLM at the addresses listed in Appendix B.

HIGHWAYS/TRANSPORTATION

DOT regulates various aspects of transportation and activities adjacent to highways. Permits are required for special fuels; restricted routes or loads; temporary trips; oversized vehicles; outdoor advertising; highway right-of-way, encroachments, and approaches; and utility mains.

DOT, Gross Vehicle Weight Division generally regulates travel by trucks, truck-tractors, buses, and equipment. Permits handled by DOT include, but are not limited to: temporary trip permit; temporary special fuel license; overwidth, overheight, and overlength permit; gross vehicle weight fees receipt; liquefied petroleum gas license; restricted route-load permit; and proportional license (apportionment). A permit is required for outdoor advertising visible from interstate and primary highways. Applications for permits may be obtained at any DOT district office. (See Appendix B.)

Permits are required from DOT, Maintenance Bureau for approaches, which include construction of driveways and other approaches intersecting public streets and highways, and encroachments, which include all private structures, devices, and facilities placed upon, over, or under the right-of-way. Encroachments also include ditches, dikes, flumes, canals, bridges, and water, sewer, electric, natural gas, and communications lines. Permits to construct utility mains and lines along state highway rights-of-way are granted by DOT, Maintenance Bureau. City councils and county commissioners grant similar approval along city streets and county roads.

Transporters of hazardous waste must obtain an identification number from SHWB. Trans-

porters who maintain offices, terminals, depots, or transfer facilities within Montana related to their hazardous waste transportation activities must also register with DHES, Solid and Hazardous Waste Bureau. Detailed reporting rules require hazardous waste generators to fill out manifest forms with the source, amount, and destination of the wastes. The transporter and the receiving hazardous waste management facility must sign and date the manifest to acknowledge receipt of the waste shipment.

INDIAN RESERVATIONS

The seven Indian reservations in Montana generally fall under the jurisdiction of EPA in regard to air quality, water quality, and hazardous waste management. Information on these programs can be obtained from the Helena office of EPA. (See Appendix B for the address and telephone number.)

The Northern Cheyenne Indian Reservation, the Flathead Indian Reservation, and the Fort Peck Indian Reservation are designated as Class I for air quality purposes. All other reservations are designated Class II. Because some off-reservation projects affect areas in or adjacent to reservation lands, EPA is sometimes asked to enter into cooperative pollution management programs with the state, the tribes, and/or the U.S. Department of the Interior, Bureau of Indian Affairs (BIA). (See Air Quality, pages 39 and 54.)

EPA also administers programs to control water pollution and provide safe drinking water. The NPDES permit protects surface water and groundwater from pollution and controls the treatment and discharge of municipal and industrial wastewater. (See NPDES Permit, page 67 and Water Quality, pages 50 and 65.) Minimum discharge limits are established by EPA and apply to all discharges except where more intensive treatment is needed to meet water quality stream standards. EPA administers a continuing monitoring program to ensure that drinking water systems are free from pollutants.

EPA has the statutory authority to regulate hazardous wastes on Indian reservations and requires hazardous waste producers to comply with detailed record-keeping and reporting requirements. (See Waste Management, pages 47 and 63.)

The seven Indian agencies in Montana and their corresponding tribes are listed in Appendix B.

LOCAL AREAS

Local agencies, the board of county commissioners, or the city or local government may have laws or regulations that can affect a bioenergy project. Local governments often have jurisdiction over building and construction, land use, utilities, roads, and some environmental concerns such as air quality. Local building departments may assume jurisdiction over the building, mechanical, plumbing, or electrical permits required for construction projects. If a local building department administers its own program, the standards must be equal to those enforced by DOC, but may extend up to 4 ½ miles outside the city limits, and may be subject to a locally imposed fee schedule. (See Building, Mechanical, Electrical, and Plumbing Permits, page 57.)

Local fire authorities also may have their own enforcement program, may require a permit, and may adopt a fee schedule. Fire safety

inspections may be conducted locally by the municipal fire chief or the county sheriff. (See Fire Safety Inspections, page 63.)

Local authorities often administer land use regulations and restrictions that may affect location of a bioenergy project. Choosing a site for a plant may be limited by zoning regulations, floodplain or wetland restrictions, or lakeshore preservation requirements. The local planning board or board of county commissioners can provide more information on land use regulations.

Supplying electric power, natural gas, and water to a site is usually regulated on a local level. The city or town council or board of county commissioners must grant permission for construction of gas, water, sewer, and other mains within the city limits and for construction of utility mains and lines along city streets and county roads. City or town councils may permit extension of utility lines outside city limits.

Written permission is required from the board of county commissioners for any excavation, construction, or other encroachment across county roads. Highway encroachments include all private structures, devices, and facilities placed upon, over, or under the right-of-way. These include ditches, dikes, flumes, canals, bridges, and water, sewer, electric, natural gas, and communications lines.

If it is necessary to connect to the local sewage treatment facility, the facility operator must be informed of the quantity and type of sewage an applicant plans to discharge to make certain it does not overload the current treatment capacity.

A municipality or county may establish a local air pollution control program. (See Urban Areas/Municipalities, page 76.)

On county lands, a burning permit may be required to ignite an open fire directly in the open air without a receptacle or in a receptacle other than a furnace, multiple-chambered incinerator, or waste-wood burner. (See Open Burning Permit, page 54.)

NAVIGABLE WATERS

DSL, Lands Division, has jurisdiction over rivers, lakes, and streams designated as navigable waters in Montana and maintains a current list of navigable waters in the state. When there will be activity on a river, lake, or stream between the low-water mark and the high-water mark, consult DSL for permitting and other requirements.

OCCUPATIONAL SAFETY AND HEALTH

All bioenergy projects must comply with occupational safety and health laws and rules. The administering agency will be either the U.S. Occupational Safety and Health Administration (OSHA) or DOLI, Safety Bureau, depending on whether the project is considered a public or a private project. A public project involves services performed by public employees for state, city, or county governments. Whenever public employees or employers are involved in a project, enforcement will be by DOLI, Safety Bureau. All other employees and employers are under the jurisdiction of OSHA.

All public bioenergy projects are required to comply with the Montana Safety Act, MCA 50-71-101 et seq. No licenses or permits are involved, but a variety of rules require compliance.

For all private bioenergy projects under the jurisdiction of OSHA that have one or more employees and for all federal employees, Montana laws and rules are superseded by federal laws and rules. In the CFR, the construction industry standards apply to the building phase of a project, and the general industry standards apply to the operational phase of a project. OSHA does not require a license or permit, but does require compliance with all the federal rules. OSHA has general, scheduled on-site health and safety inspections for businesses classified as high hazard. If, during an inspection, problems are found, the owner or contractor can be issued a citation or fined. OSHA also investigates any complaints, fatalities, or accidents. Businesses with 11 or more employees must comply with record-keeping and posting requirements, which include posting an informational poster and filing an OSHA form with a log and summary of all occupational illnesses and accidents. More information on OSHA standards can be obtained from the OSHA office in Billings, which has a toll-free telephone number. (See Appendix B.)

DOLI's Safety Bureau has a voluntary Safety Consultation Program for businesses. The program provides free occupational safety and health consultations on request. DOLI requires an agreement prior to participating that requires correction within a reasonable time of any serious occupational safety and health violations noted. There are no fines or citations for violations. For more information, contact DOLI, Safety Bureau. (See Appendix B.)

DHES, Occupational Health Bureau, has the authority to regulate occupational noise and indoor emissions in workplaces that are under the jurisdiction of state and local governments. DHES does not require or issue permits, but has established standards in these two areas. In ARM 16.42.101, DHES establishes maximum noise exposure levels that represent conditions that nearly all workers may be repeatedly exposed to without adverse effect on the ability to hear and understand normal speech. In ARM, DHES also establishes maximum threshold limit values for air contaminants that nearly all workers may be exposed to day after day without adverse effects.

For information on the Boiler Operating Certificate, Boiler Operator's License, and fire safety inspections, see Section 4, Occupational Safety and Health, page 62.

URBAN AREAS/ MUNICIPALITIES

A municipality or county may establish and administer a local air pollution control program in its jurisdiction if it is consistent with the state program and is approved by the state Board of Health and Environmental Sciences. Montana law, MCA 75-2-301, explains the requirements and restrictions involving local programs. The law allows a local program to establish more stringent or more extensive requirements than the state requires. For instance, Great Falls has stricter permit requirements for open burning.

Butte, Helena, and Missoula have adopted rules that regulate and control the emissions from residential solid fuel burning devices, which include any fireplace, fireplace insert, wood stove, wood-burning heater, wood stick boiler, coal-fired furnace, or coal stove. The rules cover devices that produce less than 1,000,000 Btus per hour in a private residence or commercial establishment. The rules regulate new installations, visible emissions during air pollution alerts, fuels, and special permits.

Cities and towns in Montana are classified according to the National Ambient Air Quality Standards (NAAQS). Nonattainment areas exceed allowable limits for certain air pollutants. Bioenergy projects locating in nonattainment areas may need to meet stricter requirements regarding emission rates, depending on the particular problem pollutants and the known concentrations of those pollutants. (See Air Quality, pages 39 and 54.)

EPA has established ambient air standards for airborne particles with a diameter of 10 microns or less. Each Montana community has been placed into one of three groups based on the probability of exceeding these standards. (See Air Quality, pages 44 and 46.)

WATER USE

Any person who wants to appropriate surface water or groundwater must apply to DNRC, Water Rights Bureau for a Beneficial Water Use Permit. Beneficial uses include agricultural, domestic, fish and wildlife, industrial, irrigation, mining, municipal, power generation, and recreation. (See Water Use, page 68.)

Water rights in Montana are in the process of being reviewed by the courts. Any entity asserting a claim for an existing use of water must file for a certificate of water right. Such entities may include individuals, partnerships, associations, public or private corporations, cities or municipalities, counties, state agencies or the State of Montana, and federal agencies of the United States of America, acting on their own behalf or as trustee for an Indian or Indian tribe. For more information on water rights, contact any DNRC Water Resources Regional Office. (See Appendix B.)

APPENDIX A
MONTANA BIOENERGY FACILITIES

The following are lists, first by technology and then by location, of operating bioenergy facilities in Montana. For details see the forthcoming DNRC publication, *Montana Bioenergy Facilities.*

PROJECTS LISTED BY TECHNOLOGY

ALCOHOL PRODUCTION FACILITIES

AlcoTech
PO Box 154
Ringling, Montana 59645
547-2116

BIOGAS FACILITIES

Billings Wastewater Treatment Plant
PO Box 30958
Billings, Montana 59111
657-8352

Bozeman Wastewater Treatment Plant
PO Box 640
Bozeman, Montana 59715
586-9159

Helena Wastewater Treatment Plant
316 North Park
Helena, Montana 59623
447-8455

Kalispell Wastewater Treatment Plant
Box 1997
Kalispell, Montana 59903
752-6600 Ext. 207

Missoula Wastewater Treatment Plant
435 Ryman
Missoula, Montana 59802
721-0111

COMBUSTION FACILITIES

American Timber Company
PO Box 128
Olney, Montana 59927
881-2311

Champion International Corporation
Drawer 7
Bonner, Montana 59823
258-2100

Champion International Corporation
PO Box 1590
Libby, Montana 59923
293-4141

Darby Lumber, Inc.
PO Box 390
Darby, Montana 59829
821-3261

F.H. Stolze Land and Lumber Company
PO Box 1429
Columbia Falls, Montana 59912
892-3252

Flathead Post and Pole
Star Route, Box 13
Dixon, Montana 59831
246-3591

Glacier Log Homes, Inc.
5560 Highway 93 South
Whitefish, Montana 59937
862-3562

Louisiana Pacific Corporation
Kentucky Avenue
Deer Lodge, Montana 59722
846-1600

Louisiana Pacific Corporation
PO Box 4007
Missoula, Montana 59806
728-3910

Mineral County Public Library
PO Box 430
301 Second Avenue East
Superior, Montana 59872-0430
822-4562

Missoula White Pine Sash Company
PO Box 7009
Missoula, Montana 59807
728-4010

Montana Southern Agricultural Research Center
748 Railroad Highway
Huntley, Montana 59037
348-3400

Northern Cheyenne Pine Company
PO Box 627
Ashland, Montana 59003
784-2367

Pack River Lumber Company
58719 Highway 93
Polson, Montana 59860
883-5908

Park County Solid Waste Recovery System
328 North M Street
Livingston, Montana 59047
222-6232

Plum Creek Manufacturing Limited
Partnership
PO Box 149
Belgrade, Montana 59714
388-4221

Plum Creek Manufacturing Limited
Partnership
PO Box 160
Columbia Falls, Montana 59912
892-2141

Plum Creek Manufacturing Limited
Partnership
PO Box 28
Fortine, Montana 59918
882-4436

Plum Creek Manufacturing Limited
Partnership
PO Box 188
Pablo, Montana 59855
675-2610

Pyramid Mountain Lumber, Inc.
PO Box 549
Seeley Lake, Montana 59868
677-2201

St. Ignatius Elementary School
PO Box 400
St. Ignatius, Montana 59865
745-2971

St. Labre Indian School
PO Box 216
Ashland, Montana 59003
784-2746

Stolze—Conner Lumber Company
PO Box 410
Darby, Montana 59829
821-3241

Stone Container Corporation
PO Box 4707
Missoula, Montana 59806
626-4451

Thompson River Lumber, Inc.
PO Box 279
Thompson Falls, Montana 59873
755-9166 or 827-4311

W-I Forest Products, LP
PO Box 369
Thompson Falls, Montana 59873
827-3511

WOOD PELLET PLANTS

Belgrade Wood Products
251 Arden Drive
Belgrade, Montana 59714
388-8866

Bitterroot Timber Products
PO Box 53
Darby, Montana 59829
821-4428

Blackfoot Forest Products
PO Box 188
Lincoln, Montana 59639
362-4868

Eureka Pellet Mills
PO Box 667
Eureka, Montana 59917
296-3109

HooDoo Mountain Pellets
1870 South Highway 2
Libby, Montana 59923
293-5019

Rocky Mountain Mills
Box 46
Ravalli, Montana 59863
745-2492

PROJECTS LISTED BY LOCATION

Ashland
- Northern Cheyenne Pine Company
- St. Labre Indian School

Belgrade
- Belgrade Wood Products
- Plum Creek Manufacturing Limited Partnership

Billings
- Billings Wastewater Treatment Plant

Bonner
- Champion International Corporation

Bozeman
- Bozeman Wastewater Treatment Plant

Columbia Falls
- F. H. Stolze Land and Lumber Company
- Plum Creek Manufacturing Limited Partnership

Darby
- Bitterroot Timber Products
- Darby Lumber Company, Inc.
- Stolze—Conner Lumber Company

Deer Lodge
- Louisiana Pacific Corporation

Dixon
- Flathead Post and Pole

Eureka
- Eureka Pellet Mills

Fortine
- Plum Creek Manufacturing Limited Partnership

Helena
- Helena Wastewater Treatment Plant

Huntley
- Montana Southern Agricultural Research Center

Kalispell
- Kalispell Wastewater Treatment Plant

Libby
- Champion International Corporation
- HooDoo Mountain Pellets

Lincoln
- Blackfoot Forest Products

Livingston
- Park County Solid Waste Recovery System

Missoula
- Louisiana Pacific Corporation
- Missoula Wastewater Treatment Plant
- Missoula White Pine Sash Company
- Stone Container Corporation

Olney
- American Timber Company

Pablo
- Plum Creek Manufacturing Limited Partnership

Polson
- Pack River Lumber Company

Ravalli
- Rocky Mountain Mills

Ringling
- AlcoTech

Seeley Lake
- Pyramid Mountain Lumber, Inc.

St. Ignatius
- St. Ignatius Elementary School

Superior
- Mineral County Public Library

Thompson Falls
- Thompson River Lumber, Inc.
- W-I Forest Products, LP

Whitefish
- Glacier Log Homes, Inc.

APPENDIX B
AGENCIES/ORGANIZATIONS

BUREAU OF BUSINESS AND ECONOMIC RESEARCH

University of Montana
Missoula, Montana 59812
243-5113

EASTERN AGRICULTURAL RESEARCH CENTER

PO Box 1350
Sidney, Montana 59270
482-2208

ELECTRIC COOPERATIVES

Montana Electric Cooperative Association
PO Box 1306
Great Falls, Montana 59403
761-8333

Beartooth Electric Cooperative, Inc.
PO Box 1119
Red Lodge, Montana 59068
446-2310

Big Flat Electric Cooperative, Inc.
PO Box H
Malta, Montana 59538
654-2040

Big Horn County Electric Cooperative, Inc.
PO Box AE
Lodge Grass, Montana 59050
639-2341

Central Montana Electric G & T Cooperative
705 Lincoln Lane
Billings, Montana 59101
248-7936

Fergus Electric Cooperative, Inc.
313 West Janeaux Street
Box 58
Lewistown, Montana 59457
538-3465

Flathead Electric Cooperative, Inc.
510 LaSalle Road
Kalispell, Montana 59901
755-5483

Glacier Electric Cooperative, Inc.
PO Box 358
410 East Main Street
Cut Bank, Montana 59427
873-5566

Goldenwest Electric Cooperative, Inc.
PO Box 245
Wibaux, Montana 59353
795-2423

Hill County Electric Cooperative, Inc.
Highway 2 West
PO Box 430
Havre, Montana 59501
265-2511

Lincoln Electric Cooperative, Inc.
PO Box 628
Eureka, Montana 59917
296-2511

Lower Yellowstone Electric Association
310 Second Avenue Northeast
Sidney, Montana 59270
482-1602

Marias River Electric Cooperative, Inc.
910 Roosevelt Highway
Shelby, Montana 59474
434-5575

McCone Electric Co-op, Inc.
PO Box 386
Circle, Montana 59215
485-3430

Mid-Yellowstone Electric Cooperative, Inc.
PO Box 386
Hysham, Montana 59038
342-5521

Missoula Electric Cooperative, Inc.
1950 Sherwood Street
Missoula, Montana 59801
549-6115

Northern Electric Cooperative, Inc.
PO Box 287
Opheim, Montana 59250
762-3352

Park Electric Cooperative, Inc.
PO Box 908
Livingston, Montana 59047
222-3100

Ravalli County Electric Co-Op, Inc.
PO Box 109
Corvallis, Montana 59828
961-3211

Sheridan Electric Cooperative, Inc.
PO Box 227
Medicine Lake, Montana 59247
789-2231

Southeast Electric Cooperative, Inc.
PO Box 368
Ekalaka, Montana 59324
775-8762

Sun River Electric Cooperative, Inc.
PO Box 217
Fairfield, Montana 59436
467-2526

Tongue River Electric Cooperative, Inc.
PO Box 138
Ashland, Montana 59003
784-2341

Upper Missouri G & T Electric Co-Op, Inc.
PO Box 1069
Sidney, Montana 59270
482-4100

Valley Electric Cooperative, Inc.
PO Box 392
Glasgow, Montana 59230
367-5315

Vigilante Electric Cooperative, Inc.
225 East Bannack Street
PO Box 71
Dillon, Montana 59725
683-2327

Yellowstone Valley Electric Co-Op, Inc.
Huntley, Montana 59037
348-3411

Federal System

Bureau of Reclamation
Great Plains Regional Office
U.S. Department of the Interior
PO Box 36900
Billings, Montana 59107
657-6535

ENVIRONMENTAL QUALITY COUNCIL

See MONTANA ENVIRONMENTAL QUALITY COUNCIL

INDIAN AGENCIES

Blackfeet Agency
Browning, Montana 59417
338-7544
(Blackfeet Tribe)

Crow Agency
Crow Agency, Montana 59022
638-2672
(Crow Tribe)

Flathead Indian Agency
PO Box 278
Pablo, Montana 59855
675-2700
(Confederated Salish and Kootenai Tribes)

Fort Belknap Agency
PO Box 98
Harlem, Montana 59526
353-2901
(Gros Ventre and Assiniboine Tribes)

Fort Peck Agency
PO Box 637
Poplar, Montana 59255
768-5312
(Assiniboine and Sioux Tribes)

Northern Cheyenne Agency
PO Box 40
Lame Deer, Montana 59043
477-8242
(Northern Cheyenne Tribe)

Rocky Boy Agency
Box Elder, Montana 59521
395-4476
(Chippewa Cree Tribe)

INTERMOUNTAIN RESEARCH STATION

See U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE, INTERMOUNTAIN RESEARCH STATION

INTERSTATE COMMERCE COMMISSION

See U.S. INTERSTATE COMMERCE COMMISSION

MONTANA AGRICULTURAL STATISTICS SERVICE

See U.S. DEPARTMENT OF AGRICULTURE, MONTANA AGRICULTURAL STATISTICS SERVICE

MONTANA DEPARTMENT OF AGRICULTURE

Growth Through Agriculture Council
Agriculture Development Division
Agriculture and Livestock Building
Sixth and Roberts
Helena, Montana 59620
444-2402

Plant Industry Division
Agriculture and Livestock Building
Sixth and Roberts
Helena, Montana 59620
444-3730

MONTANA DEPARTMENT OF COMMERCE

Building Codes Bureau
1218 East Sixth Avenue
Helena, Montana 59620
444-3933

Business Licensing Center
Business Development Division
1424 Ninth Avenue
Helena, Montana 59620
800-221-8015 or 444-4109

Science and Technology Alliance
46 North Last Chance Gulch, Suite 2B
Helena, Montana 59620
449-2778

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

Fisheries Division
Fish, Wildlife and Parks Building
1420 East Sixth Avenue
Helena, Montana 59620
444-2449

Regional Offices (direct correspondence to Fish Manager)

Region 1
PO Box 67
490 North Meridan Road
Kalispell, Montana 59903
752-5501

Region 2
3201 Spurgin Road
Missoula, Montana 59801
542-5500

Region 3
1400 South Nineteenth
Bozeman, Montana 59715
994-4042

Region 4
PO Box 6609
4600 Giant Springs Road
Great Falls, Montana 59406
454-3441

Region 5
2300 Lake Elmo Drive
Billings, Montana 59105
252-4654

Region 6
Rural Route 1, Box 4210
Glasgow, Montana 59230
228-9347

Region 7
Rural Route 1, Box 2004
Miles City, Montana 59301
232-4365

Region 8
1404 Eighth Avenue
Helena, Montana 59620
444-4720

MONTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES

Cogswell Building
Helena, Montana 59620
444-2544

Air Quality Bureau
444-3454

Occupational Health Bureau
444-3671

Solid and Hazardous Waste Bureau
444-1430 or 444-2821

Water Quality Bureau
444-2406

MONTANA DEPARTMENT OF JUSTICE

Fire Marshall Bureau
Scott Hart Building, Room 371
303 North Roberts
Helena, Montana 59620
444-2050

MONTANA DEPARTMENT OF LABOR AND INDUSTRY

Safety Bureau
PO Box 1728
Helena, Montana 59624
444-6401

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

1520 East Sixth Avenue
Helena, Montana 59620
444-6873

Conservation and Resource Development Division

Conservation Districts Bureau
444-6667

Energy Division

Conservation and Renewable Energy Bureau
444-6750

Facility Siting Bureau
444-6791

Oil and Gas Conservation Division

2535 St. Johns Avenue
Billings, Montana 59102
656-0040

Water Resources Division

Engineering Bureau
444-6646

Water Rights Bureau
444-6610

Montana Water Resources Regional Offices

Billings Field Office
1537 Avenue D, Suite 105
Billings, Montana 59102
657-2105
Serving: Big Horn, Carbon, Stillwater, Sweet Grass, Treasure, and Yellowstone Counties

Bozeman Field Office
111 North Tracy
Bozeman, Montana 59715
586-3136
Serving: Gallatin, Madison, and Park Counties

Glasgow Field Office
839 First Avenue South
PO Box 1269
Glasgow, Montana 59230
228-2561
Serving: Daniels, Dawson, Garfield, McCone, Phillips, Richland, Roosevelt, Sheridan, and Valley Counties

Havre Field Office
1708 West Second Street
PO Box 1828
Havre, Montana 59501
265-5516
Serving: Blaine, Chouteau, Glacier, Hill, Liberty, Pondera, Teton, and Toole Counties

Helena Field Office
1520 East Sixth Avenue
Helena, Montana 59620
444-6695
Serving: Beaverhead, Broadwater, Deer Lodge, Jefferson, Lewis and Clark, Powell, and Silver Bow Counties

Kalispell Field Office
3220 Highway 93 South
PO Box 860
Kalispell, Montana 59903
752-2288
Serving: Flathead, Lake, Lincoln, and Sanders Counties

Lewistown Field Office
311 West Janeaux
PO Box 438
Lewistown, Montana 59457
538-7459
Serving: Cascade, Fergus, Golden Valley, Judith Basin, Meagher, Musselshell, Petroleum, and Wheatland Counties

Miles City Field Office
5 North Prairie
PO Box 276
Miles City, Montana 59301
232-6359
Serving: Carter, Custer, Fallon, Powder River, Prairie, Rosebud, and Wibaux Counties

Missoula Field Office
Holiday Village Professional Plaza, Suite 105
PO Box 5004
Missoula, Montana 59806
721-4284
Serving: Granite, Mineral, Missoula, and Ravalli Counties

MONTANA DEPARTMENT OF PUBLIC SERVICE REGULATION

2701 Prospect Avenue, Building D
Helena, Montana 59620

Public Service Commission
444-6199

Utility Division
444-6180

MONTANA DEPARTMENT OF REVENUE

Natural Resource and Corporation Tax Division
Mitchell Building
Helena, Montana 59620
444-2441

Property Assessment Division
Steamboat Block Building
Helena Avenue
Helena, Montana 59620
444-0811

MONTANA DEPARTMENT OF STATE LANDS

Capitol Station
1625 Eleventh Avenue
Helena, Montana 59620
444-2074

Field Operations

Central Land Office
8001 North Montana Avenue
Helena, Montana 59601
444-3633

Forestry Division
2705 Spurgin Road
Missoula, Montana 59801
542-4300

Land Administration Division
1625 Eleventh Avenue
Helena, Montana 59620
444-2074

Eastern Land Office
PO Box 1794
321 Main Street
Miles City, Montana 59301
232-2034

Northeastern Land Office
PO Box 1021
USDA Building
613 Northeast Main Street
Lewistown, Montana 59457
538-5989

Northwestern Land Office
PO Box 490
2250 Highway 93 North
Kalispell, Montana 59901
752-7994

Southern Land Office
528 South Moore Lane
Billings, Montana 59101
259-3264

Southwestern Land Office
1401 Twenty-Seventh Avenue
Missoula, Montana 59801
542-4200

MONTANA DEPARTMENT OF TRANSPORTATION

Highway Building
2701 Prospect Avenue
Helena, Montana 59601
444-6201

Engineering Division
Right of Way Bureau
444-6057

Gross Vehicle Weight Division
444-6130

Motor Fuels Tax Division
Accounting Services Bureau
Gasoline Unit
444-7275

District Offices

Billings District
424 Morey
PO Box 20437
Billings, Montana 59104
252-4138

Butte District
PO Box 3068
Butte, Montana 59702
494-3224

Glendive District
503 North River Avenue
PO Box 890
Glendive, Montana 59330
365-5296

Great Falls District
104 Eighteenth Avenue Northeast
PO Box 1359
Great Falls, Montana 59403
727-4350

Missoula District
2100 West Broadway
PO Box 7039
Missoula, Montana 59807
549-6491

MONTANA ELECTRIC COOPERATIVE ASSOCIATION

See ELECTRIC COOPERATIVES

MONTANA ENVIRONMENTAL QUALITY COUNCIL

Room 106, State Capitol
Helena, Montana 59620
444-3742

PUBLIC SERVICE COMMISSION

See MONTANA DEPARTMENT OF PUBLIC SERVICE REGULATION

U.S. ARMY CORPS OF ENGINEERS

Omaha District
PO Box 5
Omaha, Nebraska 68101-0005
402-221-4133

U.S. BUREAU OF ALCOHOL, TOBACCO, AND FIREARMS

Regional Director (Compliance)
221 Main Street, Eleventh Floor
San Francisco, California 94105
415-744-7011

U.S. DEPARTMENT OF AGRICULTURE

Agricultural Stabilization and Conservation Service
PO Box 670
Bozeman, Montana 59771-0670
587-6872

Forest Service
Intermountain Research Station
324 Twenty-Fifth Street
Ogden, Utah 84401
801-625-5434

Montana Agricultural Statistics Service
PO Box 4369
Helena, Montana 59604
449-5303

National Forest Offices

Beaverhead National Forest
PO Box 1258
610 North Montana Street
Dillon, Montana 59725
683-5900

Bitterroot National Forest
316 North Third Street
Hamilton, Montana 59840
363-3131

Custer National Forest
PO Box 2556
2602 First Avenue North
Billings, Montana 59103
657-6361

Deerlodge National Forest
PO Box 400
Federal Building
400 North Main Street
Butte, Montana 59703
496-3400

Flathead National Forest
PO Box 147
1935 Third Avenue East
Kalispell, Montana 59901
755-5401

Gallatin National Forest
PO Box 130
Federal Building
Bozeman, Montana 59715
587-6702

Helena National Forest
Federal Building
301 South Park Street
Drawer 10014, Room 334
Helena, Montana 59626
449-5201

Kootenai National Forest
Rural Route 3, Box 700
506 Highway 2 West
Libby, Montana 59923
293-6211

Lewis and Clark National Forest
PO Box 871
1101 Fifteenth Street North
Great Falls, Montana 59403
721-7720

Lolo National Forest
Fort Missoula, Building 24
Missoula, Montana 59801
329-3797

U.S. DEPARTMENT OF THE INTERIOR

Bureau of Indian Affairs
316 North Twenty-Sixth Street
Billings, Montana 59101
657-6315

Bureau of Land Management*
Montana State Office
222 North Thirty-Second Street
PO Box 36800
Billings, Montana 59107-6800
255-2885

*Headquarters for three-state area: Montana, North Dakota, and South Dakota

District Offices

Butte District Office
PO Box 3388
106 North Parkmont
Butte, Montana 59702
494-5059

Lewistown District Office
PO Box 1160
Airport Road
Lewistown, Montana 59457
538-7461

Miles City District Office
PO Box 940
West of Miles City
Miles City, Montana 59301
232-4331

U.S. ENVIRONMENTAL PROTECTION AGENCY

Drawer 10096
301 South Park Avenue
Helena, Montana 59626-0096
449-5432

U.S. FEDERAL ENERGY REGULATORY COMMISSION

Division of Interconnection and System Analysis
Qualifying Facilities and Interconnection Branch
825 North Capitol Street Northeast
Washington, DC 20426
202-208-0200

U.S. INTERSTATE COMMERCE COMMISSION

Public Information Office
Twelfth Street and Constitution Avenue Northwest
Washington, DC 20423
202-275-7252

Western Regional Office
211 Main Street, Suite 500
San Francisco, California 94105
415-744-6520

U.S. OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

19 North Twenty-Fifth Street
Billings, Montana 59101
800-448-7087

APPENDIX C
BIOMASS RESOURCES

INTRODUCTION

Montana's wood products, agricultural, and municipal sectors produce a wide variety of biomass resources. These resources have been detailed in publications such as *Energy from Crops and Agricultural Residues in Montana* (Haines 1987), *Mill Residue Availability in Montana* (Keegan and Fong 1987), and *Forest Residue Availability in Montana* (Keegan and Hearst 1988). DNRC plans to publish a collection of these energy resource inventories in the forthcoming *Montana Bioenergy Resources*.

DSL, Forestry Division in Missoula has surveyed timber resources in Montana and published the results in five publications that cover all land in Montana, regardless of ownership. More current information about land under federal ownership can be obtained from BLM district offices or from any of the ten national forest headquarters in Montana. BBER of the University of Montana in Missoula and the Intermountain Research Station in Ogden, Utah, have informative publications pertaining to timber resources, mill residues, and forest residues.

WOOD RESOURCES

Montana has approximately 800 commercial logging firms, and many of them can be considered commercial biomass suppliers. One hundred sixty-seven of those firms are listed in the 1991 edition of the *Directory of Montana's Forest Products Industry* by DSL, which is referenced in the bibliography. This directory lists sawmills and other operations that might market wood wastes and logging contractors who might supply timber or residues.

Mill residues are the least expensive residue available. Table 13 lists the amounts of bark and sawdust available from 1977 to 1988. Details on the amounts of all mill residues can be found in *Mill Residue Availability in Montana*, by Charles Keegan and Tat Fong.

Forest residues would be available in the wooded areas of Montana shown in Figure 15. The map shows forested areas of Montana excluding the alpine regions. Wilderness areas, national parks, and other areas may be unavailable as a source of biomass, but are included on the map because areas occasionally are available for salvage. For more details on forest residue, see *Forest Residue Availability in Montana*, by Charles Keegan and A. Lorin Hearst.

Several commercial and institutional facilities use wood pellets to fuel wood furnaces or boilers in Montana. The state's six pellet plants, listed in Appendix A, Montana Bioenergy Facilities, supply dealers around the state and also sell directly to larger customers.

Addresses for all of the state and federal agencies that compile information on biomass resources in Montana are listed in Appendix B. Table 14, Information Sources for Biomass Availability, lists agencies and others who could help identify and locate biomass materials.

AGRICULTURAL RESOURCES

Biomass feedstocks for energy can include wheat, barley, oats, and corn for ethanol production (see Table 15), straw from grain crops for direct combustion (see Table 16), safflower and canola oilseed for conversion to diesel fuel extenders or substitutes, and manure for biogas production or direct combustion. Grains or other agricultural crops can be purchased from a grower or a grain elevator. Agricultural industry wastes are often available directly from the industry involved. Crop residues such as straw are available from farmers or ranchers and are generally located in areas illustrated in Figure 16. Safflower and canola oilseed are available in some areas of Montana shown in Figures 17 and 18. These crop and residue resources were determined from information published by MASS.

MASS is a joint federal and state agency supported by the U.S. Department of Agriculture (USDA) and DOA. It is the primary source for statistical information on farming and ranching operations in Montana. Another source for data on agricultural residues is USDA, Agricultural Stabilization and Conservation Service (ASCS) in Bozeman. A secondary source of information is DOA. Publications by some of these sources are listed in the bibliography.

SOLID WASTE RESOURCES

At the time of this writing the solid waste disposal regulations are being rewritten by EPA. The new regulations favor recycling, waste reduction, and combustion over landfilling, which is listed as a last resort. DHES, Solid and Hazardous Waste Bureau can identify municipal solid waste sources (see Table 17) and new regulations.

TABLE 13

AVAILABLE BARK AND SAWDUST
(Thousands of Dry Tons)

COUNTY GROUPS	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Beaverhead Area	44	40	38	28	35	31	52	70	71	71	81	79
Broadwater Area	35	41	41	32	32	26	31	35	40	40	31	24
Carbon Area	1	1	1	1	1	1	1	1	1	1	0	0
Flathead County	72	79	85	84	84	71	115	114	110	111	132	146
Granite Area	44	49	41	36	28	19	36	44	61	62	80	44
Lake Area	100	96	88	61	70	58	92	92	82	88	89	91
Lincoln County	96	85	94	59	75	64	99	106	115	122	138	128
Missoula County	102	105	105	89	81	80	94	90	92	96	100	70
LUMBER TOTAL	495	496	492	390	406	350	521	552	574	592	651	581
PLYWOOD TOTAL	34	34	31	0	0	0	0	0	0	0	35	30
GRAND TOTAL	529	530	523	390	406	350	521	552	574	592	686	611

FIGURE 15

AREAS WITH FOREST RESIDUE POTENTIAL

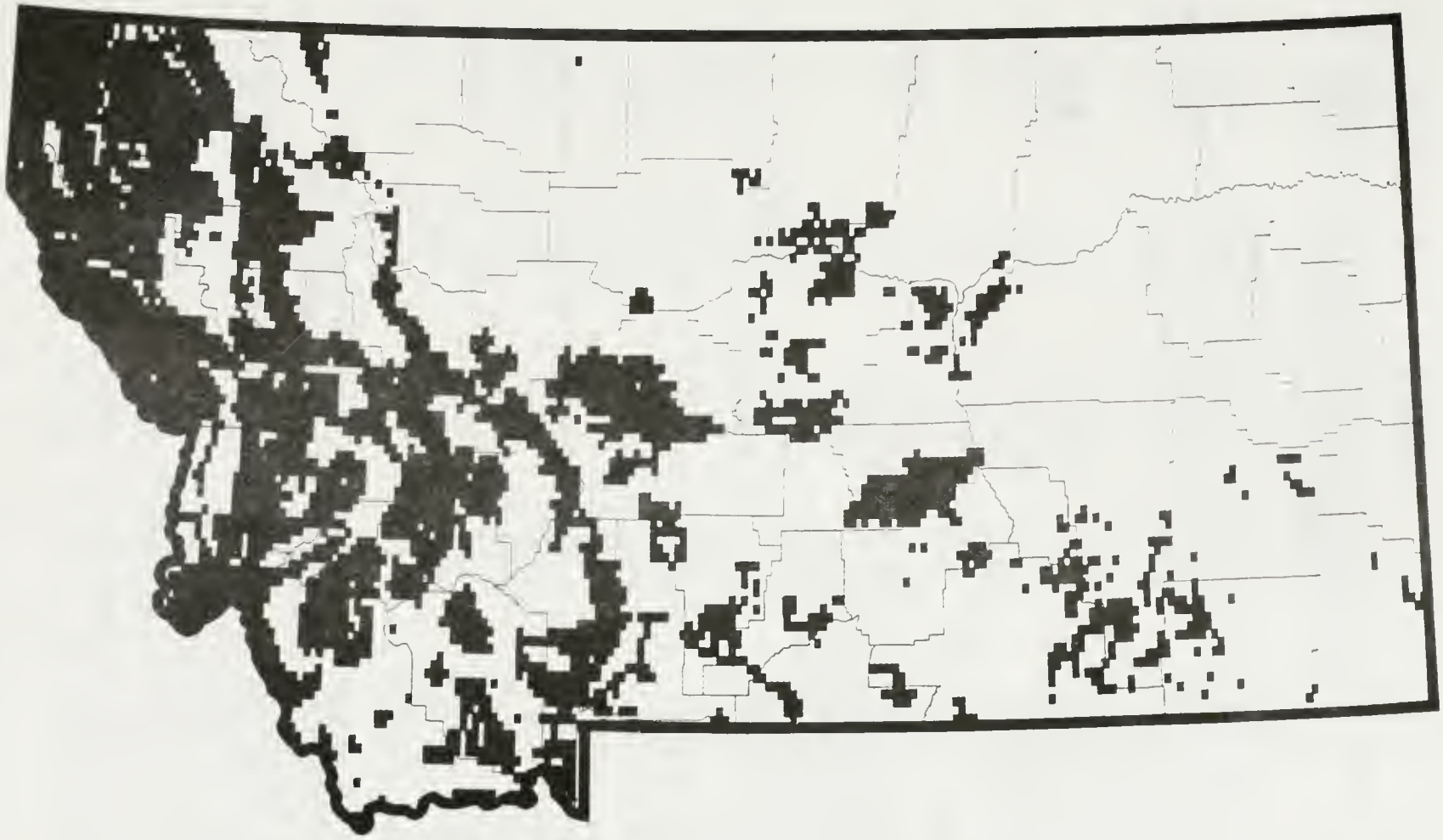


TABLE 14

INFORMATION SOURCES FOR
BIOMASS AVAILABILITY

Resources	Agency Contacts*	Private Contacts
Wood products Trees (wood, cellulose) Forest residue Wood pellets	BBER BLM DSL USFS	Sawmills Commercial logging firms
Agricultural resources Agricultural crops Agricultural crop residue Agricultural industry waste Sunflowers, safflowers	ASCS DOA MASS	Grain elevators
Food processing waste	DHES, SHWB and WQB	Individual businesses
Animal manure	DOA MASS	Feedlots Dairies
Industrial waste (liquid and solid)	DHES, SHWB and WQB	Individual industries
Municipal waste (liquid and solid)	DHES, SHWB	Private waste haulers

ASCS—U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service
BBER—Montana Bureau of Business and Economic Research, University of Montana
BLM—U.S. Department of the Interior, Bureau of Land Management
DHES, SHWB—Montana Department of Health and Environmental Sciences, Solid and Hazardous Waste Bureau
DHES, WQB—Montana Department of Health and Environmental Sciences, Water Quality Bureau
DOA—Montana Department of Agriculture
DSL—Montana Department of State Lands
MASS—Montana Agricultural Statistics Service
USFS—U.S. Department of Agriculture, Forest Service

* The Montana Department of Natural Resources and Conservation, Energy Division, may be contacted for general information on all resources.

TABLE 15

POTENTIAL ETHANOL PRODUCTION (IN GALLONS) FROM DISTRESSED GRAINS BASED ON A PERCENTAGE OF TOTAL HARVEST*

COUNTY	1985 WHEAT AND BARLEY (2 PERCENT)	1986 WHEAT, BARLEY, AND CORN (1 PERCENT)	1987 WHEAT, BARLEY, AND CORN (1 PERCENT)	1988 WHEAT, BARLEY, AND CORN (1 PERCENT)	4-YEAR AVERAGE
Deer Lodge	3,500	2,200	2,400	3,100	2,800
Flathead	98,700	69,500	81,600	85,300	83,775
Granite	2,000	1,200	1,300	1,300	1,450
Lake	81,300	66,500	33,000	52,100	58,225
Lincoln	300	200	0	0	125
Mineral	800	400	100	500	450
Missoula	5,000	6,800	7,300	9,300	7,100
Powell	7,400	11,200	9,200	13,700	10,375
Ravalli	13,500	15,400	13,700	20,300	15,725
Sanders	4,000	1,900	2,100	4,200	3,050
NORTHWEST	216,500	175,300	150,700	189,800	183,075
Blaine	112,300	150,600	244,600	177,900	171,350
Chouteau	329,400	597,700	528,800	379,600	458,875
Glacier	102,200	157,400	211,000	175,400	161,500
Hill	269,900	452,800	460,400	314,700	374,450
Liberty	119,800	276,500	248,400	135,900	195,150
Phillips	79,300	135,300	146,000	96,700	114,325
Pondera	161,600	319,700	364,700	306,200	288,050
Teton	223,200	280,100	332,300	372,400	302,000
Toole	102,800	218,400	243,000	173,800	184,500
NORTH CENTRAL	1,500,500	2,588,500	2,779,200	2,132,600	2,250,200
Daniels	64,900	129,600	130,900	60,000	96,350
Dawson	456,500	462,400	384,000	189,700	373,150
Garfield	44,000	48,500	86,000	37,900	54,100
McCone	121,800	1,389,000	180,000	81,300	443,025
Richland	389,900	42,400	429,000	347,800	302,275
Roosevelt	112,200	186,400	245,000	82,700	156,575
Sheridan	98,800	212,000	184,000	100,900	148,925
Valley	218,000	296,700	242,000	103,700	215,100
NORTHEAST	1,506,100	2,767,000	1,880,900	1,004,000	1,789,500

Table 15 (continued)

COUNTY	1985 WHEAT AND BARLEY (2 PERCENT)	1986 WHEAT, BARLEY, AND CORN (1 PERCENT)	1987 WHEAT, BARLEY, AND CORN (1 PERCENT)	1988 WHEAT, BARLEY, AND CORN (1 PERCENT)	4-YEAR AVERAGE
Broadwater	56,000	68,600	57,700	72,500	63,700
Cascade	125,900	234,800	195,000	196,600	188,075
Fergus	177,800	188,900	28,600	254,900	162,550
Golden Valley	11,000	28,400	29,500	24,300	23,300
Judith Basin	84,800	106,400	150,000	111,100	113,075
Lewis & Clark	26,900	23,500	42,700	35,100	32,050
Meagher	6,200	41,800	32,400	18,200	24,650
Musselshell	14,100	36,000	32,800	29,800	28,175
Petroleum	4,300	21,000	13,600	10,500	12,350
Wheatland	10,600	29,100	38,200	30,900	27,200
CENTRAL	517,600	778,500	620,500	783,900	675,125
Beaverhead	40,300	26,000	37,400	47,300	37,750
Gallatin	151,700	123,500	163,300	176,100	153,650
Jefferson	8,800	13,000	19,600	10,400	12,950
Madison	30,800	20,400	32,800	30,000	28,500
Silver Bow	800	1,400	1,700	2,000	1,475
SOUTHWEST	232,400	184,300	254,800	265,800	234,325
Big Horn	522,900	500,000	441,600	922,700	596,800
Carbon	350,200	352,000	315,200	871,000	472,100
Park	16,100	24,200	26,200	23,300	22,450
Stillwater	58,800	75,900	76,000	96,700	76,850
Sweet Grass	4,300	13,100	13,200	7,600	9,550
Treasure	404,700	4,015,000	634,500	625,100	1,419,825
Yellowstone	353,300	325,000	622,000	849,600	537,475
SOUTH CENTRAL	1,710,300	5,305,200	2,128,700	3,396,000	3,135,050
Carter	46,700	29,400	47,200	9,300	33,150
Custer	765,800	758,800	801,500	709,000	758,775
Fallon	57,700	37,200	51,600	11,700	39,550
Powder River	41,400	20,500	31,700	9,700	25,825
Prairie	146,200	152,000	273,000	249,000	205,050
Rosebud	1,022,000	999,000	781,000	1,333,000	1,033,750
Wibaux	40,100	34,900	41,400	13,200	32,400
SOUTHEAST	2,119,900	2,031,800	2,027,400	2,334,900	2,128,500
STATE TOTALS	7,803,300	13,830,600	9,842,200	10,107,000	10,395,775

* Numbers may not be exact due to rounding.

TABLE 16

TOTAL STRAW AVAILABLE (IN DRY TONS) AFTER CONSERVATION*

COUNTY	1985	1986	1987	1988	4-YEAR AVERAGE
Deer Lodge	147	173	534	391	311
Flathead	114,752	19,519	31,334	11,144	44,187
Granite	1,084	201	64	155	376
Lake	2,810	5,599	9,986	2,506	5,225
Lincoln	11	64	0	0	19
Mineral	325	97	48	113	146
Missoula	28	387	748	1,317	620
Powell	197	1,376	544	1,389	877
Ravalli	454	2,609	868	1,134	1,266
Sanders	666	195	574	487	481
NORTHWEST	120,476	30,221	44,700	18,636	53,508
Blaine	0	9,332	23,658	230	8,305
Chouteau	1,078	102,601	93,762	24	49,366
Glacier	15	1,109	35,043	1,263	9,357
Hill	0	79,910	77,279	17	39,302
Liberty	0	48,530	25,151	0	18,420
Phillips	236	8,027	12,198	0	5,115
Pondera	0	69,882	95,327	502	41,428
Teton	94,718	39,900	99,500	18,330	63,112
Toole	0	10,566	28,389	0	9,739
NORTH CENTRAL	96,047	369,857	490,308	20,366	244,145
Daniels	0	0	856	0	214
Dawson	118	94	24,345	0	6,139
Garfield	1,308	0	17,156	0	4,616
McCone	1,393	146	27,547	0	7,271
Richland	5,534	2,745	17,513	49	6,460
Roosevelt	7	81	8,192	0	2,070
Sheridan	1,840	2,046	1,886	0	1,443
Valley	3,246	15	6,287	0	2,387
NORTHEAST	13,447	5,127	103,781	49	30,601

Table 16 (continued)

COUNTY	1985	1986	1987	1988	4-YEAR AVERAGE
Broadwater	367	12,212	14,165	1,447	7,048
Cascade	0	32,568	39,126	2,119	18,453
Fergus	48	25,449	96,288	12,893	33,670
Golden Valley	563	3,121	5,726	0	2,353
Judith Basin	0	11,976	46,923	0	14,725
Lewis & Clark	0	3,480	3,823	1,789	2,273
Meagher	0	6,624	4,038	20	2,671
Musselshell	0	7,320	509	116	1,986
Petroleum	0	4,927	403	20	1,338
Wheatland	0	1,648	10,405	0	3,013
CENTRAL	978	109,325	221,407	18,405	87,529
Beaverhead	789	2,680	11,663	2,909	4,510
Gallatin	3683	35,723	68,639	19,266	31,828
Jefferson	0	1,871	8,241	621	2,683
Madison	6916	1,743	11,577	998	5,309
Silver Bow	880	24	369	17	322
SOUTHWEST	12,268	42,041	100,488	23,811	44,652
Big Horn	18,464	24,310	28,481	211	17,867
Carbon	25,043	5,795	6,193	283	9,328
Park	217	4,547	6,807	250	2,955
Stillwater	718	3,435	9,716	110	3,495
Sweet Grass	34	2,266	3,279	0	1,395
Treasure	9,036	2,988	3,334	425	3,946
Yellowstone	78,299	24,084	32,558	690	33,908
SOUTH CENTRAL	131,810	67,426	90,367	1,969	72,893
Carter	0	1	12,342	0	3,086
Custer	6,734	215	10,836	357	4,535
Fallon	0	0	8,266	0	2,067
Powder River	29	977	10,937	0	2,986
Prairie	1,230	446	11,630	17	3,331
Rosebud	15,511	1,607	18,737	143	8,999
Wibaux	0	9	4,297	0	1,077
SOUTHEAST	23,504	3,254	77,044	517	26,080
STATE TOTALS	398,530	627,252	1,128,095	83,753	559,408

* Numbers may not be exact due to rounding.

FIGURE 16

AREAS OF SURPLUS STRAW

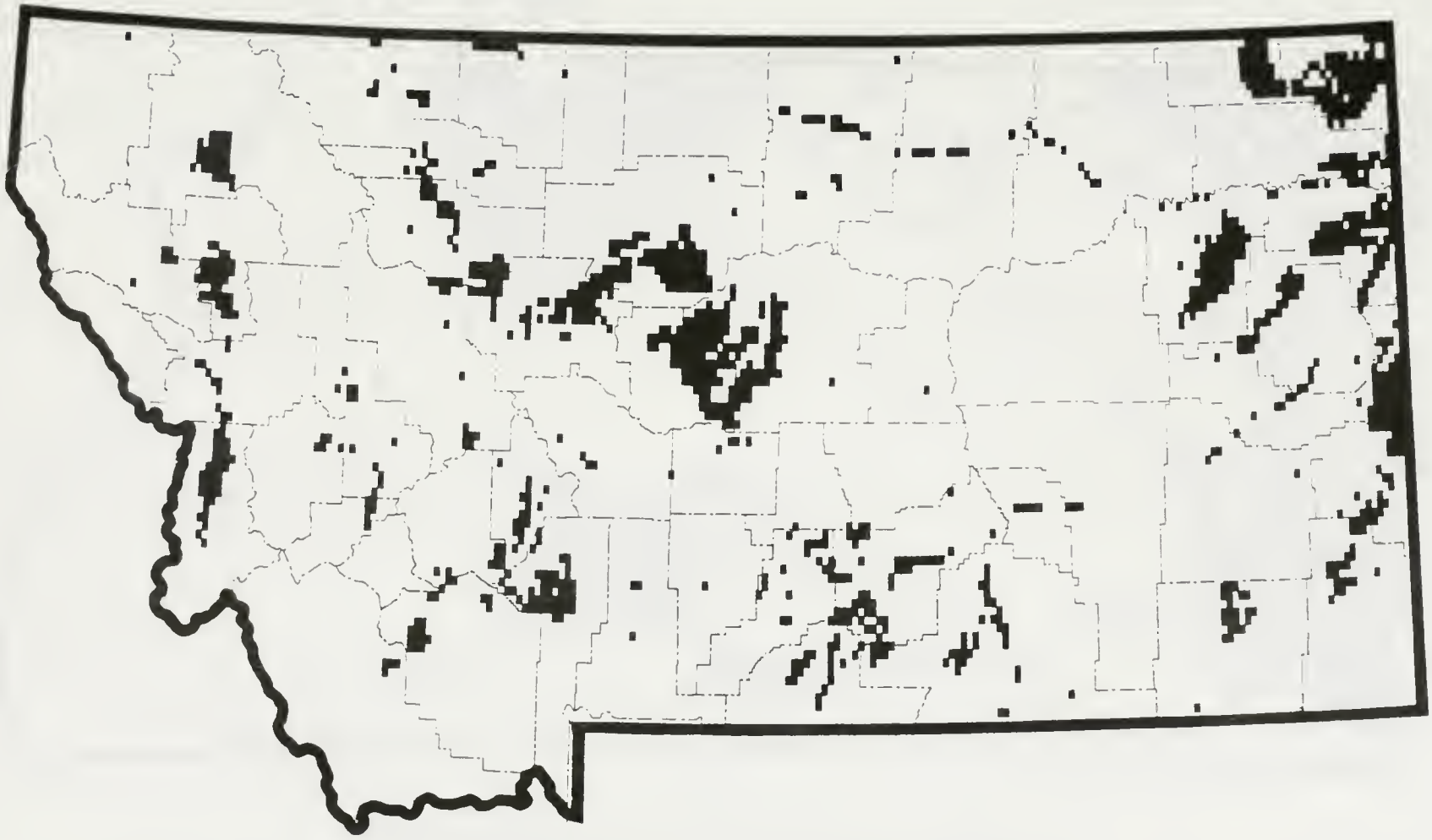


FIGURE 17

AREAS WITH SAFFLOWER PRODUCTION POTENTIAL

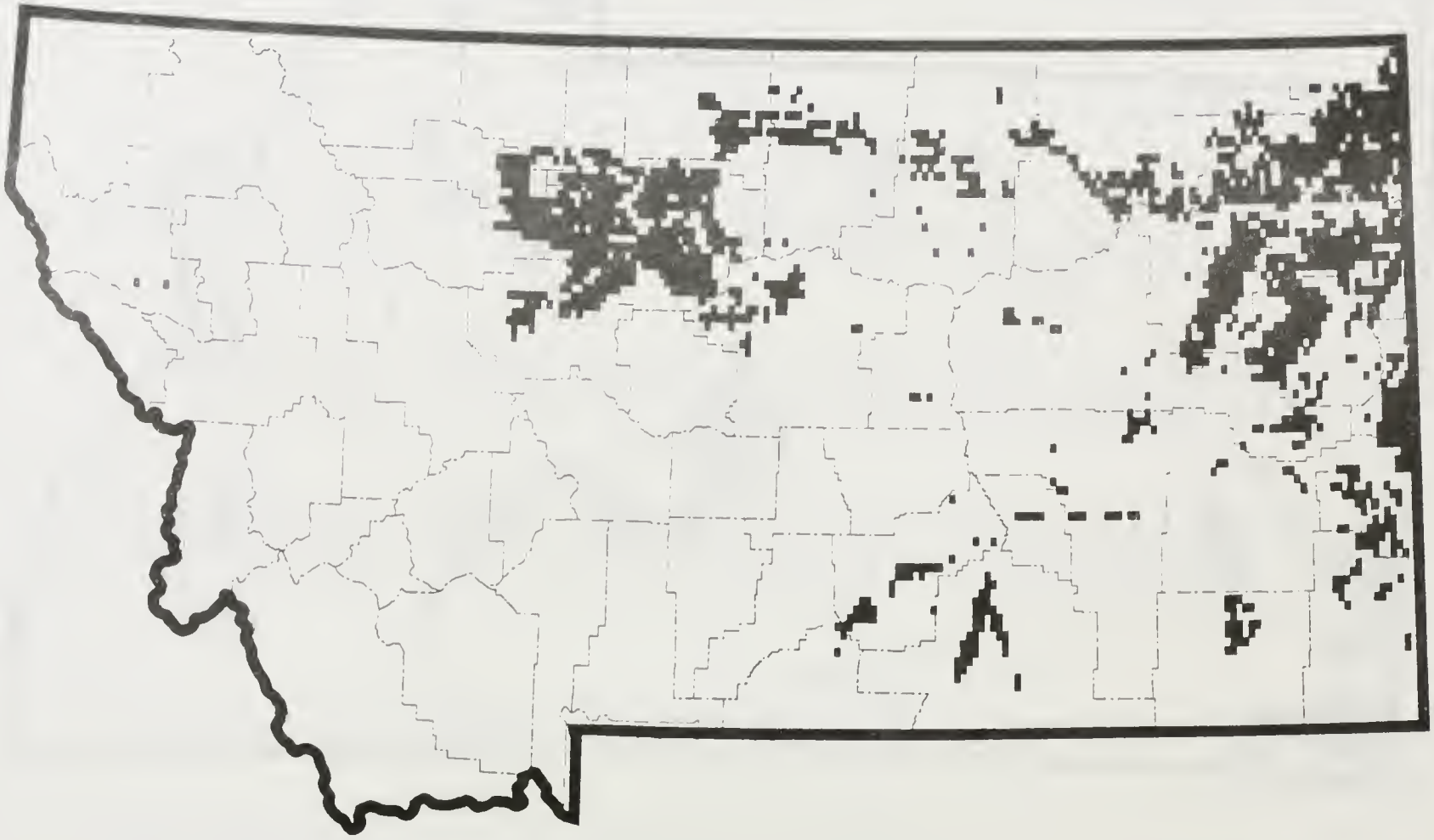
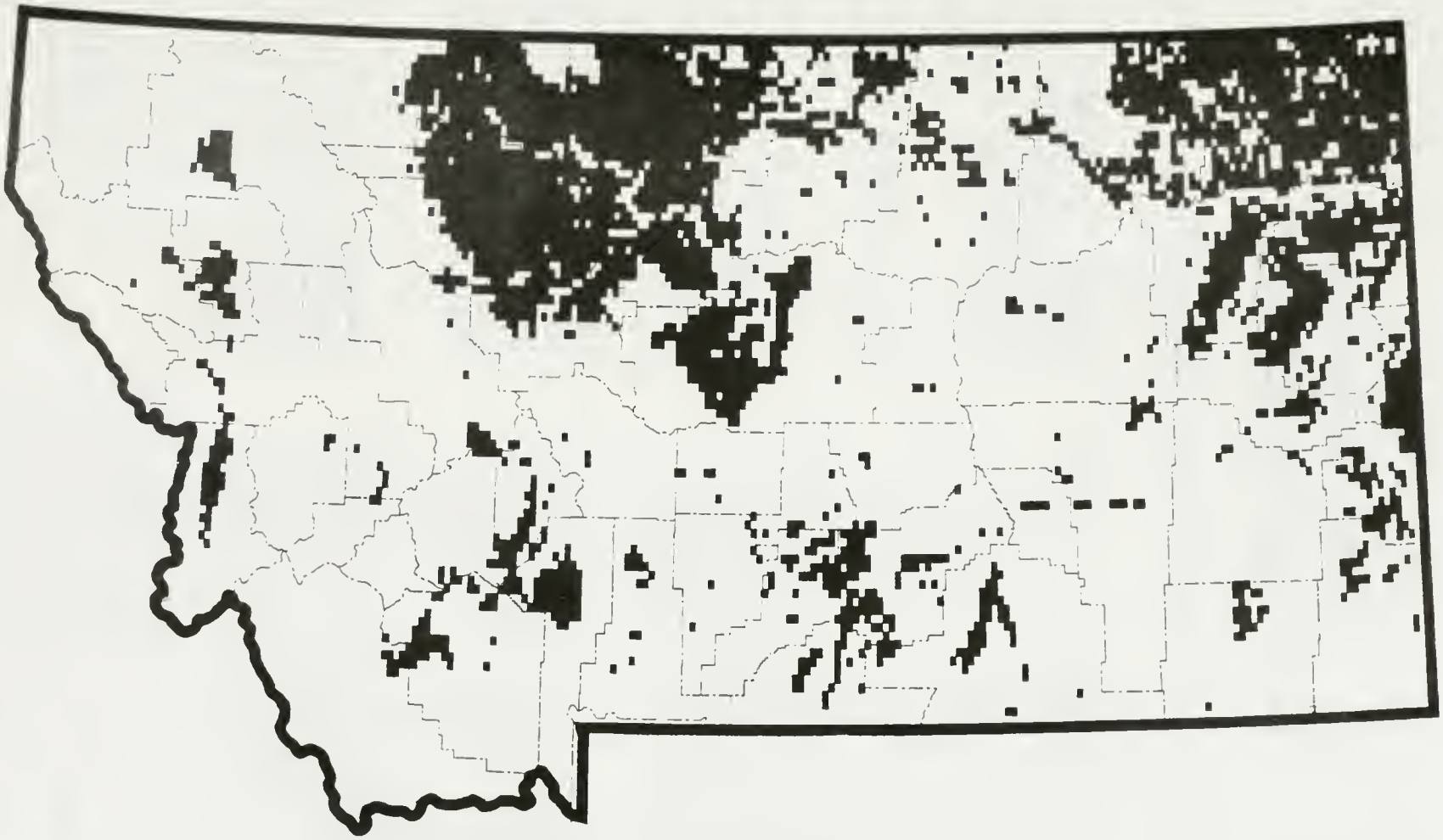


FIGURE 18

AREAS WITH CANOLA PRODUCTION POTENTIAL



REFERENCES AND SELECTED BIBLIOGRAPHY

✿ Adams, T. C. September 1983. *Operational Costs of Harvesting Logging Residues for Use of Energy*. BPA PNWA-11. Portland, OR: Pacific Northwest Forest and Range Experiment Station.

✪ *Administrative Rules of Montana*. 1991. Helena, MT: Secretary of State.

✦ Alsager, Melvin D. January 1985. *Manure Collection and Digestion Research Project*. BPA PNWA-48. Walnut Creek, CA: Brown and Caldwell, Consulting Engineers.

✘ Bergman, Jerald. December 1987. *Germplasm Evaluation and Selection of Safflower Oils and Co-Products for Alternative Fuel Production*. #85-1065. Helena, MT: Montana Department of Natural Resources and Conservation.

✦ Bio-Energy Enterprises, Inc. August 1984. *Methane Production from Anaerobic Digestion: Testing Program and Feasibility Study*. BPA PNWA-69. Salem, OR: Oregon Department of Energy.

✿ Bishop, Daniel M., Steven C. Jacoby, Richard Amermon, and Frank Holman, of Environaid. May 7, 1985. *Recovery and Use of Wood Waste Generated in the City Boroughs of Juneau and Sitka*. BPA PNWA-38. Anchorage, AK: Alaska Department of Commerce.

★ Boucher, Robert J. November 1983. *Cogeneration Feasibility Study Comparison of Rankine vs Stirling Engines Adapted To A Solid-Fuel Combustor*. #RJB-661. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ _____, and Howard E. Haines, Jr. June 1990. *Adiabatic Bicoannular Reactor Development*. #83-1032. Helena, MT: Montana Department of Natural Resources and Conservation.

✦ Breckenridge, Leon, of Bio-Energy Enterprises, Inc. August 1984. *Methane Production from Anaerobic Digestion: Testing Program and Feasibility Study*. BPA PNWA-76. Olympia, WA: Washington State Energy Office.

KEY

✪ General introductory and regulatory
✣ Alcohol fermentation
✦ Anaerobic digestion and biogas
★ Cogeneration
✣ Densification and pellets
✸ Direct combustion
✔ Gasification, liquefaction, and pyrolysis
✘ Oilseed extraction
✿ Recovery, resources, and economics

✣ Bronec, Larry, and Charles Bronec. June 1983. *Demonstration of an Alcohol Fuel Plant and Straw Boiler.* #437-811. Helena, MT: Montana Department of Natural Resources and Conservation.

★ Brooks, C. M., T. R. Duranti, D. R. Wilson, C. R. Roberts, and R. W. Urmstron. August 1981. *Centralized Cogeneration System for the Tacoma Tideflats Industrial Area.* BPA PNWA-08. Redmond, WA: Rocket Research Company.

✿ Brown, L. F., and J. A. Begrall. 1986. *Small Tree Harvest System Recovering for Energy.* BPA PNWA-16. Olympia, WA: Washington Department of Natural Resources.

★ _____, and L. S. Craig, of Larry Brown & Associates. May 1983. *Preliminary Feasibility Study for a Cogeneration Plant at Rough & Ready Lumber Company.* BPA PNWA-65. Salem, OR: Oregon Department of Energy.

✿ _____, L. S. Craig, and P. Buscaglia. 1984. *Evaluating Double-Entry Logging for Forest Residue Recovery in Southwest Oregon.* BPA PNWA-18. Grants Pass, OR: Larry Brown & Associates.

✸ Burnet, Paul G., and Carl A. Simons, of OMNI Environmental Services, Inc. July 1988. *Identification of Factors Which Affect Combustion Efficiency and Environmental Impacts From Woodstoves.* BPA PNWA-30d. Portland, OR: Bonneville Power Administration.

★ Carroll, Hatch and Associates, Inc. April 1983. *A Feasibility Study for Avison Lumber Company on Power Production.* BPA PNWA-66. Salem, OR: Oregon Department of Energy.

★ _____. May 1983. *A Feasibility Study for Fort Vancouver Plywood Company on Building and Operating Power Generating Facilities.* BPA PNWA-74. Salem, OR: Oregon Department of Energy.

★ _____. August 7, 1985. *A Report to Wrangell Forest Products on Plant-Site Forest Generation.* BPA PNWA-40. Anchorage, AK: Alaska Department of Commerce.

✪ *Code of Federal Regulations.* 1991. Washington, DC: Office of the Federal Register, National Archives and Records Administration.

✸ Cowlitz-Wahkiakum Governmental Conference. November 1984. *Cowlitz County Solid Waste Disposal Alternatives Analysis.* BPA PNWA-75. Olympia, WA: Washington State Energy Office.

✸ Cozby Enterprises and MultiTech. February 1988. *Prototype Development of the Unitary Steam Engine.* #84-1046. Helena, MT: Montana Department of Natural Resources and Conservation.

★ Crane, Charles, and MERDI. July 1982. *Central Biomass Combustion Facility Feasibility Study.* #303-782. Helena, MT: Montana Department of Natural Resources and Conservation.

★ Cuett, Jeff. September 1984. *Feasibility Study of Biomass Cogeneration Project for Lakeview, Oregon.* BPA PNWA-72. Salem, OR: Oregon Department of Energy.

Davidson, Patty. April 1989. *Montana Air Quality Data and Information Summary for 1987.* Helena, MT: Department of Health and Environmental Sciences.

✿ Dolan, L. S., P. Schroeder, M. Gillham, K. Clark, and E. Smith-Omar. November

1984. *The Cultural Treatment of Selected Species for Woody Biomass Production in the Pacific Northwest*. BPA PNWA-03. Seattle, WA: Seattle City Light.

✣ Dratz, William, and Dan Miles. September 1980. *An Empirical Study On The Use of Straight Alcohol Fuels Prepared From Feedstock Including Barley, Wheat, and Potatoes*. #423-801. Helena, MT: Montana Department of Natural Resources and Conservation.

❖ Eagle Energy Systems, Inc. April 1983. *Feasibility and Design Study—240 Ton Per Day Wood Refining Densification Facility With 2.0 Megawatts Cogeneration For Eureka, Montana*. #467-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ ECO Northwest, Ltd. September 1984. *Residential Wood Fuel Use Assessment*. #ECO-739. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Envirosphere Company. January 1987 and June 1988. *Regional Logging Residue Supply Curve Project*. Volumes 1 and 2. DOE/BP-18507 1 & 2. BPA PNWA-27. Portland, OR: Bonneville Power Administration.

★ Frounfelker, Richard, and Joseph Swartzbough. March 1982. *City of Helena: Evaluation and Design Of Solid Waste Resource Recovery Facility*. #311-800. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Gauthier, Carol, and Mike Gauthier. September 1984. *Stick Wood Boiler Demonstration Project For Residential Applications*. #320-811. Helena, MT: Montana Department of Natural Resources and Conservation.

★ Gent, F. M., of General Electric Company, and Brice Miller of Flodin Lumber Company. July 1983. *A Three Megawatt Biomass-Fired Cogeneration Plant Feasibility Study*. #FL-651. Helena, MT: Montana Department of Natural Resources and Conservation.

★ GeoProducts. August 1986. *Feasibility of a 15-MW Wood-fired and Geothermal Power Plant*. #GP-624. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Goetz, Hank, of Montana Forest and Range Conservation Experiment Station. May 1986. *Thinning on Steep Terrain With Low-Cost Cable Yarders*. #FCES-732. Helena, MT: Montana Department of Natural Resources and Conservation.

Great Lakes Regional Biomass Energy Program, Council of Great Lakes Governors. 1988. *Biomass Energy Facilities—1988 Directory of the Great Lakes Region*. Chicago, IL: Great Lakes Regional Biomass Energy Program, Council of Great Lakes Governors.

✸ Greene, William T., of OMNI Environmental Services, Inc. June 1988. *Cost/Benefit Analyses of Mitigation Measures for Minimizing Environmental Impacts of Residential Wood*

KEY

✪ General introductory and regulatory
✣ Alcohol fermentation
✦ Anaerobic digestion and biogas
★ Cogeneration
❖ Densification and pellets
✸ Direct combustion
✔ Gasification, liquefaction, and pyrolysis
✘ Oilseed extraction
✿ Recovery, resources, and economics

Combustion. BPA PNWA-30f. Portland, OR: Bonneville Power Administration.

✸ _____, and Carl A. Simons, of OMNI Environmental Services, Inc. June 1988. *Estimating the Volume of Residential Wood Burning in the Pacific Northwest and Alaska*. BPA PNWA-30c. Portland, OR: Bonneville Power Administration.

✸ _____, Carl A. Simons, and James E. Houck, of OMNI Environmental Services, Inc. June 1988. *Mitigation Measures for Minimizing Environmental Impacts From Residential Wood Combustion*. BPA PNWA-30e. Portland, OR: Bonneville Power Administration.

✿ Haines, Howard E., Jr. January 1987. *Bionote: Steep Slope Timber Thinning Studies*. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ _____. August 1987. *Energy From Crops and Agricultural Residues in Montana*. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ _____. January 1988. *Bionote: High Tech Ag Industry in Montana's Future*. Helena, MT: Montana Department of Natural Resources and Conservation.

✘ _____. August 1988. *Bionote: Breeding a Diesel Fuel Extender—A Potential New Montana Crop*. Helena, MT: Montana Department of Natural Resources and Conservation.

_____. August 1988. *Directory of Montana Biomass Energy Facilities*. Helena, MT: Montana Department of Natural Resources and Conservation.

✘ _____. June 1989. *Bionote: Process Improvements Pave Way for Safflower Diesel Fuel*. Helena, MT: Montana Department of Natural Resources and Conservation.

✘ _____. September 1989. *Montana's Fuel Safflower Activities*. Helena, MT: Montana Department of Natural Resources and Conservation.

✦ _____, and Dan Vichorek. January 1987. *Bionote: Montana Studies Use of Chicken Manure to Produce Methane for Heat, Electricity*. Helena, MT: Montana Department of Natural Resources and Conservation.

★ Hall, Ken, of Morrison Knudson. August 1983. *University of Idaho: Cogeneration Feasibility Study*. BPA PNWA-42. Boise, ID: Idaho Department of Water Resources.

✘ Hammaker, Geneva, Mary Lou Marino, Craig E. Simons, Paul O. Kresge, and Steven J. Harvey. February 1983. *Liquid Biofuels in Montana—Assessment of the Oil Seed Resource*. #DPRA-595. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Hemphill, Dallas, of Logging Engineering International, Inc. April 1989. *Kinzua Forest Residues Utilization: The Economics of Forest Residue Recovery Systems in an Eastern Oregon Logging Operation*. BPA PNWA-87. Portland, OR: Bonneville Power Administration.

❖ Hoban, Pat, and Howard E. Haines, Jr. August 1988. *Bionote: Pellet Makers Ready For Boom*. Helena, MT: Montana Department of Natural Resources and Conservation.

★ Holladay, Mike, of Holladay Engineering Company, and Payette and Malheur Counties. November 1983. *Cogeneration Feasibility Study for Municipal Solid Waste Incineration Facilities*. BPA PNWA-45. Boise, ID: Idaho Department of Water Resources.

✿ Host, John R. June 1989. *Productivity and Cost of Processing Fuelbark in Montana*. #JH-066. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Houck, James E., Carl A. Simons, and Lyle C. Pritchett, of OMNI Environmental Services, Inc. June 1988. *Estimating Carbon Monoxide Air Quality Impacts From Woodstoves*. BPA PNWA-30a. Portland, OR: Bonneville Power Administration.

✿ Howard, J. O., and C. Fiedler. May 1983. *Assessment of Logging Residue in Montana*. BPA PNWA-15. Portland, OR: Pacific Northwest Forest and Range Experiment Station.

✿ _____, and C. Fiedler. July 1984. *Estimators and Characteristics of Logging Residue in Montana*. BPA PNWA-15. Portland, OR: Pacific Northwest Forest and Range Experiment Station.

✦ Hunter, Robert, of Brown and Caldwell Consulting Engineers. November 1984. *Montana Farms: Biogas/Cogeneration Feasibility Study*. #83-1028. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Ince, P. J., J. W. Henley, J. B. Grantham, and D. L. Hunt. April 1984. *Costs of Harvesting Beetle-Killed Lodgepole Pine in Eastern Oregon*. BPA PNWA-01. Portland, OR: U.S. Forest Service, Pacific Northwest Forest and Range Experiment Station.

✸ Irwin, T. C. August 1984. *Grass Straw as a Viable Source of Home Heating Fuel*. BPA PNWA-70. Cheshire, OR: Irwin & Sons.

✿ Johnson, L., R. Aldrich, and H. Lee. February 28, 1987. *Recovery of Forest Residues Harvest and Collection Systems*. BPA PNWA-29. Moscow, ID: University of Idaho.

✿ _____, and F. Castaneda, of the Forest Products Department, University of Idaho. June 1984. *Evaluating Double-Entry Logging for Forest Residue Recovery in the Intermountain Region*. BPA PNWA-46. Boise, ID: Idaho Department of Water Resources.

✣ Kania, Bruce, of A. E. Montana, Inc. December 1981. *Fuel Ethanol Plant Near Amsterdam, Montana*. #457-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Keegan, Charles E., III. October 1987. *Montana Mill Residue Assessment And Simulation System—User's Guide*. #BBER-997A. Helena, MT: Montana Department of Natural Resources and Conservation.

KEY

✪ General introductory and regulatory
✣ Alcohol fermentation
✦ Anaerobic digestion and biogas
★ Cogeneration
❖ Densification and pellets
✸ Direct combustion
✓ Gasification, liquefaction, and pyrolysis
✘ Oilseed extraction
✿ Recovery, resources, and economics

✿ Keegan, Charles E., III, and Tat Fong, of the Bureau of Business and Economic Research. October 1987. *Mill Residue Availability in Montana.* #BBER-997. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ _____, and A. Lorin Hearst. November 1988. *Forest Residue Availability in Montana.* #BBER-021. Helena, MT: Montana Department of Natural Resources and Conservation.

Kelley, Patricia, Vicki Rieffenberger, and Dan Vichorek. June 1987. *Saving Energy on Montana Farms and Ranches.* Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Kemmis, Daniel, of Bitterroot Resource Conservation and Development, Inc. February 1988. *Assessment of Expanding Wood Pellet Use in Mineral, Missoula, and Ravalli Counties.* #86-1069. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ Kent, Gary, Stuart Kilgore, Don Brelsford, and Daniel Parks. May 1981. *Fuel Ethanol and Torula Yeast From Coniferous Wood Biomass - Thompson Falls, Montana.* #411-801. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Kerr, Calvin L., of Valley Sawmill. December 31, 1985. *Final Report: Small Sawmill Residue Utilization Demonstration.* BPA PNWA-39. Anchorage, AK: Alaska Department of Commerce.

Kerstetter, James D. August 1987. *Washington Directory of Biomass Energy Facilities.* WAOENG-87-19. Olympia, WA: Washington State Energy Office.

✸ Kinzey, Bruce, and W. E. Larsen. August 1986. *Performance Optimization of a Farm-Scale Direct-Fired Biomass Furnace.* #84-1042. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ Law, James, and Warren P. Scarrah. January 1983. *Low Energy Ethanol Dehydration Via Barley Absorption.* #441-811. Helena, MT: Montana Department of Natural Resources and Conservation.

★ Leibrock, Frank R. November 1983. *Cogeneration Feasibility Study for the Snake River Cattle Company.* BPA PNWA-41. Boise, ID: Idaho Department of Water Resources.

★ Limaye, Dilip R., Shahzad Qasim, and Howard E. Haines. May 1983. *Montana Biomass Cogeneration Manual: A Workshop Handbook.* #SRC-653. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Little, Mark A., Lee Erickson, and Gilbert F. Stallkneckt. October 1984. *Utilization of Biomass to Dry Whole Corn.* #83-1025. Helena, MT: Montana Department of Natural Resources and Conservation.

✔ Marenco, Inc. March 1982. *Wood Gasification/Power Generation Development Project.* BPA PNWA-02. Anchorage, AK: Marenco, Inc.

✸ Matney Frantz Engineering. July 1984. *Dillon Incineration Project.* #468-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ _____. May 1985. *Municipal Solid Waste Recovery Station Feasibility Report (for Western Montana College).* #WMC-740. Helena, MT: Montana Department of Natural Resources and Conservation.

✦ McBride, John, and Lauren McKinsey. December 1979. *Biogas Conversion Assessment Project*. #412-781. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ McCahon, Dennis, Peggy Todd, Jeff Birkby, Howard E. Haines, Jr., and Carole Massman. June 1988. *Wood Heat*. Helena, MT: Montana Department of Natural Resources and Conservation.

★ McGuckin, Michael, of Idaho Hardwoods. May 1983. *Cogeneration Feasibility Study: Idaho Hardwoods*. BPA PNWA-43. Boise, ID: Idaho Department of Water Resources.

✣ MERDI. June 1981. *Fuel Ethanol Production By Fermentation In Intermediate-Sized Plants*. #430-800. Helena, MT: Montana Department of Natural Resources and Conservation.

✪ Miles, T. R., Jr., T. R. Miles, Sr., L. S. Craig, and W. T. Greene. October 1984. *Guide to Oregon's Environmental Permits for Biomass Energy Projects*. BPA PNWA-68. Salem, OR: Oregon Department of Energy.

✸ Miles, Thomas R. May 1980. *Report of Shelton Wood/Coal Firing Tests*. BPA PNWA-05. Beaverton, OR: Thomas R. Miles.

✸ Miles, Thomas R., Jr. October 1988. *Straw Combustion Energy Systems*. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Molde, Clint, and William Larsen, of Montana State University. June 1987. *Potential for On Farm Biomass Gasification in Montana*. #84-1056. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Montana Agricultural Statistics Service. 1989. *Montana Agricultural Statistics, 1989*. Helena, MT.

✪ *Montana Code Annotated*. 1991. Helena, MT: Montana Legislative Council.

Montana Department of Commerce, Business Development Division. January 1990. *Guide to Montana's Economic Development and Business Development Programs*. Helena, MT.

✿ _____. January 1990. *Montana Business Licensing Handbook*. Helena, MT.

Montana Department of Health and Environmental Sciences. 1990. *Montana Water Quality 1990*. Helena, MT.

_____. 1991. *Montana Air Quality Data and Information Summary for 1989*. Helena, MT.

Montana Department of Natural Resources and Conservation. April 1981. *Proceedings - A Public Forum - Biofuels and Other Alternative Energy*. #711-811. Helena, MT.

KEY

✪ General introductory and regulatory
✣ Alcohol fermentation
✦ Anaerobic digestion and biogas
★ Cogeneration
⁘ Densification and pellets
✸ Direct combustion
✓ Gasification, liquefaction, and pyrolysis
✘ Oilseed extraction
✿ Recovery, resources, and economics

✦ Montana Department of Natural Resources and Conservation. March 1982. *Proceedings - Methane/Biogas Conference.* #712-821. Helena, MT.

_____. 1989. *Straw Combustion Energy Systems..* Helena, MT.

_____. December 1989. *Montana Historical Energy Statistics.* Sixth Edition. Helena, MT.

_____. Forthcoming. *Montana Bioenergy Facilities.* Helena, MT.

✿ Montana Department of Natural Resources and Conservation, Forestry Division and Intermountain Range and Experiment Station. December 1979. *Timber Resources of Gallatin, Park and Meagher Counties.* Missoula, MT.

Montana Department of State Lands, Forestry Division. 1987. *Directory of Montana's Forest Industry Contractors.* Missoula, MT.

_____. 1991. *Directory of Montana's Forest Products Industry.* Missoula, MT.

✿ _____, and Intermountain Range and Experiment Station. December 1982. *Timber Resources of Lincoln, Sanders, Flathead and Lake Counties: Working Circle 1.* Missoula, MT.

✿ _____, and Intermountain Range and Experiment Station. April 1983. *Timber Resources of Mineral, Missoula and Ravalli Counties: Working Circle 2.* Missoula, MT.

✿ _____, and Intermountain Range and Experiment Station. January 1984. *Timber Resources of the Headwater Counties: Working Circle 3.* Missoula, MT.

✿ _____, and Intermountain Range and Experiment Station. July 1984. *Timber Resources of Eastern Montana: Working Circles 4, 5, 6, 7, and 8.* Missoula, MT.

✿ Montana State University and Montana Department of Natural Resources and Conservation. May 1986. *Wood Pellet Study for the Residential Market.* #86-1069A. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ MultiTech. June 1982. *Fuel Ethanol Production From Wood Waste: Feasibility of a Plant at Anaconda, Montana.* #451-811A. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ _____. June 1985. *Fuel Grade Ethanol Production Using Wood Waste (Residues) At Selected Sites in Montana.* #451-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ Mycotech Bioproducts, Inc. November 1989. *Biological Delignification of Wood and Straw for Ethanol Fuel Production via Solid State Culture.* #86-1066. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ Nuxoll, Tom, and Dan Poling. August 1984. *Study of a Portable Chipper to Chip Wastewood at Sawmills For Use as Fuel at a Pulp Mill in Missoula.* #NPCC-621. Helena, MT: Montana Department of Natural Resources and Conservation.

✪ OMNI Environmental Services, Inc. September 1986. *Compendium of Environmental and Safety Regulations and Programs Affecting Residential Wood Heating Appliances.* BPA PNWA-30b. Portland, OR: Bonneville Power Administration.

✸ OMNI Environmental Services, Inc. January 1988. *Environmental Impact of Advanced Biomass Combustion Systems.* BPA PNWA-34. Portland, OR: Bonneville Power Administration.

Peppersack, Jeff, and Gerry Galinato. January 1987. *Idaho Directory of Biomass Energy Facilities.* Boise, ID: Idaho Department of Water Resources.

✪ Perlmutter, Steven J. May 1988. *Montana Index of Environmental Permits.* Helena, MT: Environmental Quality Council.

✸ Polette, Doug. July 1978. *Fire Tube Wood Boiler For Domestic Use.* #374-761. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Rafferty, K., of Geo-Heat Center, Oregon Institute of Technology. April 1984. *Retrofit Considerations for Biomass Fuel Use at Seven Selected Correction Facilities in Washington State.* BPA PNWA-73. Olympia, WA: Washington State Energy Office.

✣ Renewable Technologies, Inc. October 1983. *Ambient Temperature Starch Hydrolysis For Barley.* #417-821. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ _____. June 1987. *Commercial Development Ambient Temperature Starch Hydrolysis.* #84-1044. Helena, MT: Montana Department of Natural Resources and Conservation.

✦ Robbins, John E. July 1982. *Research Into The Factors Affecting The Bioconversion of Cattle Manure And Cellulosic Material Mixtures To Bio-Gas.* #486-761, 401-772, 403-782, 404-801, and 458-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✪ Runnion, Ken, Raelen Williard, Howard E. Haines, Jr., Georgia Brensdal, and Jeff Birkby. July 1986. *Montana Bioenergy Project Permitting Guidebook.* Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Sampson, G., A. P. Richmond, G. A. Breuster, and A. F. Gasbarro. July 1987. *Potential For Firing Wood Chips With Coal in Internal Alaska.* BPA PNWA-23. Portland, OR: Pacific Northwest Forest and Range Experiment Station.

✣ Sampson, G. R., and F. A. Ruppert. December 1982. *Evaluation of Interior Alaska Biomass for Compressed Residential Firelogs.* BPA PNWA-10. Portland, OR: Pacific Northwest Forest and Range Experiment Station.

✘ Scarrah, Warren P., of Montana State University. August 1986. *Chemical Processing of Vegetable Oil Fuels to Prevent Polymerization.* #84-1041. Helena, MT: Montana Department of Natural Resources and Conservation.

KEY

✪ General introductory and regulatory
✣ Alcohol fermentation
✦ Anaerobic digestion and biogas
★ Cogeneration
✣ Densification and pellets
✸ Direct combustion
✔ Gasification, liquefaction, and pyrolysis
✘ Oilseed extraction
✿ Recovery, resources, and economics

✘ Scarrah, Warren P., of Montana State University. February 1989. *Conversion of Safflower Oil to Diesel via the Soap-Pyrolysis Process.* #86-1065. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Schnitzer Steel Products Company and Ebasco Services, Inc. August 1984. *Biomass Energy Production at the Schnitzer Steel Products Company.* BPA PNWA-71. Salem, OR: Oregon Department of Energy.

★ Seton, Johnson, & Odell, Inc., and Port of Morrow County. August 1983. *Biomass Cogeneration Feasibility Study.* BPA PNWA-64. Salem, OR: Oregon Department of Energy.

✔ Shaffer, Daniel L., of the Chemical Engineering Department, Montana State University. March 1985. *Liquid Fuel and Chemicals From Renewable Cellulosic Biomass.* #83-1031. Helena, MT: Montana Department of Natural Resources and Conservation.

✘ _____. October 1986. *Contamination of Diesel Engine Lubrication Oil by Plant Oil Derivative Fuels.* #84-1040. Helena, MT: Montana Department of Natural Resources and Conservation.

✘ _____. November 1988. *Plant Oil Diesel Fuel: Lubrication System Contamination.* #86-1067. Helena, MT: Montana Department of Natural Resources and Conservation.

Sifford, Alex. July 1987. *Directory of Oregon Biomass Energy Facilities.* Salem, OR: Oregon Department of Energy.

✸ Simons, Carl A., Paul D. Christianson, James E. Houck, and Lyle C. Pritchett, of OMNI Environmental Services, Inc. June 1988. *Woodstove Emission Sampling Methods Comparability Analysis and In-Situ Evaluation of New Technology Woodstoves.* BPA PNWA-30g. Portland, OR: Bonneville Power Administration.

✪ Simpson, Stuart J. June 1988. *Guide to Washington's Permits for Biomass Energy Projects.* Olympia, WA: Washington State Energy Office.

✿ Smith, Sherwin K., and Hank Goetz. March 1982. *Timber Thinning Project For Utilization Of Wood Residue.* #317-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Smith, T. G. November 1985. *Alaska Charcoal Production Feasibility Study.* BPA PNWA-37. Anchorage, AK: Alaska Department of Commerce.

★ Stoeckley, Robert. September 1983. *Electric Generation Home Wood-Fired Steam Engine.* #301-821. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ Stookey, Lawrence L. June 1984. *Construction and Operation of a Portable Still to Process Agricultural Culls for Fuel Grade Ethanol.* #439-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Stout, B. B., J. A. Parker, and Steve Ottenbreit. October 1985. *The Feasibility of Using Biomass For Fuel At the University of Montana.* #BS-733. Helena, MT: Montana Department of Natural Resources and Conservation.

✔ Tillman, D. A., of Ebasco Services, Inc. April 1984. *Wind River Nursery: Wood Gasification-Based Cogeneration Facility, Applicability of the Marenco Gasifier.* BPA PNWA-20.1. Portland, OR: Bonneville Power Administration.

✔ _____. April 1984. *Wind River Nursery: Wood Gasification-Based Cogeneration Facility at the Wind River Nursery.* BPA PNWA-20.2. Portland, OR: Bonneville Power Administration.

✣ Todd, Peggy, and Howard E. Haines, Jr. January 1987. *Bionote: Energy Potential of Leafy Spurge, Cattails and Fuel Beets.* Helena, MT: Montana Department of Natural Resources and Conservation.

✪ *United States Code.* 1988. Washington, DC: U.S. Government Printing Office.

✸ Van Hersett, David G., of Resource Development Associates, and Rayson Brothers Logging Co. May 1985. *Libby Bioenergy Project.* #84-1045. Helena, MT: Montana Department of Natural Resources and Conservation.

★ _____, and the Sandpoint Cogeneration Study Group. May 1983. *Final Report: To Conduct a Detailed Wood-Fired Cogeneration Feasibility Study of the Sandpoint, Priest River and Bonners Ferry Areas of Northern Idaho.* BPA PNWA-44. Boise, ID: Idaho Department of Water Resources.

✸ Vichorek, Dan. January 1987. *Bionote: Corn Cobs to be Burned in Place of Fossil Fuels.* Helena, MT: Montana Department of Natural Resources and Conservation.

✸ _____. January 1987. *Bionote: Future of Household Wood Burners Tough to Call.* Helena, MT: Montana Department of Natural Resources and Conservation.

✸ _____. January 1987. *Bionote: Industry Investigates Wood and Coal Fuel to Replace Oil.* Helena, MT: Montana Department of Natural Resources and Conservation.

_____. January 1987. *Bionote: Solar Power Prevents Stock Water Freezing.* Helena, MT: Montana Department of Natural Resources and Conservation.

✘ _____. November 1987. *Bionote: Researchers Find Way to Make Safflower Oil Into Diesel Fuel.* Helena, MT: Montana Department of Natural Resources and Conservation.

✘ _____, and Howard E. Haines, Jr. August 1987. *Bionote: Researchers Make Breakthrough in Adapting Vegetable-Based Diesel Fuel.* Helena, MT: Montana Department of Natural Resources and Conservation.

Vranizan, John M., Peter Neild, Linda S. Craig, Lawrence F. Brown, Robert L. Gay, and Dick DeZeeuw, of Carroll, Hatch and Associates, Inc. July 1987. *Biomass Energy Project Development Guidebook.* BPA PNWA-35. Portland, OR: Bonneville Power Administration.

KEY

✪ General introductory and regulatory
✣ Alcohol fermentation
✦ Anaerobic digestion and biogas
★ Cogeneration
✣ Densification and pellets
✸ Direct combustion
✔ Gasification, liquefaction, and pyrolysis
✘ Oilseed extraction
✿ Recovery, resources, and economics

✦ Ward, David M. July 1982. *A Comprehensive Survey Of Biological Methane Production From Agricultural, Domestic and Industrial Resources of Montana.* #402-772, 402-782, and 435-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✔ Watters, Lawrence. December 1984. *Biomass Conversion Using Gasification and Catalytic Combustion: Process Design and Application.* #LJW-650. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ Wiatr, Stanley, M., of Eastern Montana College. March 1984. *Bionote: Fuel Beets—A Prospective Energy Crop For Montana.* #82-1005. Helena, MT: Montana Department of Natural Resources and Conservation.

✿ _____. June 1984. *Bionote: Biomass Potential of Leafy Spurge.* #445-811A. Helena, MT: Montana Department of Natural Resources and Conservation.

✣ _____. August 1986. *Bionote: Energy and Biomass Potential of Cattails in Montana.* #445-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Winsor, Herbert C. November 1980. *Bionote: An Investigation Into Utilizing Wood Waste In The Lewis and Clark County Area For Space Heat In Medium-Sized Buildings.* #301-801. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ Woodell, Patricia. November 1986. *Bionote: An Inventory of Industrial and Commercial Boilers Burning Wood or Related Biomass Fuels in Alaska.* Anchorage, AK: Alaska Energy Authority, Department of Commerce and Economic Development.

✸ Wrench, Richard G. April 1982. *Bionote: Development of an Efficient Fireplace Insert Stove.* #322-811. Helena, MT: Montana Department of Natural Resources and Conservation.

✸ _____. October 1984. *Bionote: Overall Efficiency Of An Integrated Energy Production Management System And a Fireplace Insert.* #84-1036. Helena, MT: Montana Department of Natural Resources and Conservation.

KEY

✪ General introductory and regulatory
✣ Alcohol fermentation
✦ Anaerobic digestion and biogas
★ Cogeneration
❖ Densification and pellets
✸ Direct combustion
✔ Gasification, liquefaction, and pyrolysis
✘ Oilseed extraction
✿ Recovery, resources, and economics

INDEX

Agricultural Residues, 10, 12, 13, 16, 17, 20, 22, 23, 25, 26, 29, 33, 34, 38, 94, 96
Agricultural Resources, 10, 12, 13, 36, 94, 96-103
Agriculture, 52-53
  commodities, 15, 36, 52
  feed dealer's permit, 14, 15, 36, 52
  feed registration, 15, 52
  grain storage, 53
Air Quality, 39-47, 54-55
  air pollution, indoor, 76
  air toxics, 43, 46
  burning permits, 6, 42, 54-55, 75, 76
  Indian reservations, 41, 43, 45, 47, 74
  local programs, 76
  nonattainment requirements, xii, 14, 24, 27, 43, 46, 55, 77
  odor control, 12, 14, 16, 18, 19, 22, 24, 25, 28, 31, 33, 37, 42
  PM-10 ambient air quality standards, 12, 14, 16, 18, 19, 21, 22, 25, 27, 28, 35, 37, 40, 42, 43, 44, 46-47, 77
  pollutants, 13, 17, 20, 22, 23, 26, 29, 32, 34, 36, 38, 39, 40, 42
  prevention of significant deterioration, 14, 18, 19, 21, 24, 25, 27, 43, 45, 46, 55
  urban areas/municipalities, 76-77
  wilderness areas, 45
Air Quality Construction and/or Operating Permits, 5, 6, 12, 14, 18, 19, 21, 24, 25, 27, 33, 37, 39, 41, 51, 54
Alcohol Distributor's License, 14, 15, 56
Alcohol Fermentation, 2, 10, 11, 12-15, 40, 51, 56
Alcohol Fuel Producer's Permit, 5, 14, 15, 51, 56
Alcohol Plants, 12, 79
Anaerobic Digestion, ix, 2, 10, 11, 16-18, 31, 40, 51
Animal Confinement Facilities, 16, 66
Asbestos, 42

BACT, see *Best Available Control Technology*
BATF, see *U.S. Bureau of Alcohol, Tobacco, and Firearms*
Beneficial Water Use Permit, 14, 18, 21, 24, 27, 51, 68-69, 77
Benzene, 35, 42
Benzopyrene, 49
Beryllium, 42
Best Available Control Technology (BACT), ix, 19, 25, 28, 41, 55
Bioenergy, ix, 2, 19, 25
Bioenergy Facilities, 39, 79-82
Bioenergy Projects
  economic factors, 3, 39
  environmental considerations, 39, 43, 46, 47, 49, 50, 74, 75, 77
  financing, 6
  occupational safety and health, 75-76
  planning, 2, 3, 4, 33, 35, 46, 75
  sale of products, 6
  site selection, 3, 75
  wastes, 47-50
Bioenergy Technologies, 2, 9, 10
Biogas, ix, 2, 10, 16, 17, 20, 25, 31, 32, 94
Biogas Facilities, 79
Biomass, x, 2, 16, 19, 22, 25, 32, 33, 93-104

Biomass Energy, see *Bioenergy*
Biomass Resources, 10, 25, 93-104
Boiler Operating Certificate, 14, 15, 18, 20, 21, 24, 27, 30, 33, 62
Boiler Operator's License, 14, 15, 18, 20, 21, 24, 27, 30, 33, 62-63
Bonding Requirements, 3, 15, 56
Briquettes, see *Densification*
Building Permits, 5, 6, 14, 18, 21, 23, 24, 27, 30, 31, 35, 37, 51, 57, 74
Building Regulations
  biomass energy projects, 6, 74
  fire safety inspections, 14, 18, 21, 24, 27, 63, 74-75
Business Licensing, 14, 18, 21, 24, 27, 71
Butanol, x, 10, 13, 49

Canola, x, 10, 35, 36, 94, 103
Carbon Monoxide, 28, 40, 42, 43, 44, 46, 47, 54
Certificate of Public Need and Environmental Compatibility, 5, 21, 33, 61
Clean Air Act, Federal, 19, 41, 42, 43, 46, see also *Air Quality* and *Montana Clean Air Act*
Cogeneration, x, 2, 10, 11, 19-21, 25, 26, 40, 51, 71-72
Combustion Facilities, see *Direct Combustion*
Commodity Dealer's License, 14, 15, 36, 52
Creosote, 49
Cubes, see *Densification*

Dam Safety, 72
Densification, xi, 2, 10, 11, 22-24, 40, 51
  wood pellet plants, 22, 23, 24, 81, 93
  wood pellets, 22, 23, 24, 93, 96
Diesel Fuel Substitute, see *Oilseed Extraction*
Direct Combustion, 2, 10, 11, 25-27, 40, 51, 79, 94

EARC, see *Eastern Agricultural Research Center*
Eastern Agricultural Research Center, 35, 83
Electric Cooperatives, 72, 83-85
Electrical Energy Producer's License, 14, 18, 21, 24, 27, 30, 72
Electrical Energy Producer's Tax, 18, 21, 24, 27, 30, 72
Electrical Permit, 5, 14, 18, 21, 23, 24, 27, 30, 31, 35, 37, 51, 58, 72, 74
Energy Costs, see inside back cover
Environmental Impact Statement (EIS), see *Montana Environmental Policy Act*
Environmental Policy Act, see *Montana Environmental Policy Act*
Ethanol, xi, 10, 12, 13, 15, 43, 56, 94, 97-98

Facility Siting, see *Major Facility Siting*
Feed Dealer's Permit, 14, 15, 36, 52
Feedstocks, 12, 13, 17, 20, 22, 23, 26, 29, 32, 33, 34, 36, 37, 38, 93-104
FERC, see *U.S. Federal Energy Regulatory Commission*
Fire Hazard Reduction/Certificate of Clearance, 24, 27, 59
Fire Safety Inspections, 14, 18, 21, 24, 27, 63, 74-75
Flax Seed, 35
Floodplain Development Permit, 14, 18, 21, 24, 27, 60, 75
Fluorides, 42, 44
Forests and Forestry, 59, 73
  burning, 6, 42, 51
  fire hazard reduction agreements, 24, 59
  forest residues, 10, 12, 19, 20, 23, 24, 25, 26, 27, 29, 30, 33, 34, 37, 38, 51, 93, 94, 95, 96
  removal of dead or inferior timber, 24, 27, 30, 33, 37, 59, 73
  slash disposal, 33, 37, 42, 59, 73
  timber sales on federal lands, 73
  timber sales on state lands, 73

Garbage Dumps, see *Waste Disposal*
Gas Wells, 31
Gasification, xi, 2, 10, 11, 28-30, 40, 49, 51
Gasohol, xi, 14, 15, 56
Gasoline License Tax on Gasahol, 14

Hazardous Waste Act, see *Montana Hazardous Waste Act*
Hazardous Waste Management Facility Permit, 14, 18, 21, 24, 27, 49, 63-64
Hazardous Waste Reporting Requirements, 12, 14, 16, 18, 19, 21, 22, 24, 27, 28, 33, 35, 37, 48-50, 74
Hazardous Wastes, see *Transportation* and *Waste*
Highways, 73-74
  advertising, 73
  approach permits, 73
  driveways, 73
  encroachments, 73, 75
  utility easements, 73, 75
  vehicle regulations, 6, 73
Hog Fuel, 12, 16, 20, 22, 25, 28, 33, 37, 47
Hyacles Process, 33
Hydrocarbons, 10, 34, 38, 49, 54
Hydrogen Sulfide, 42, 44

Indian Agencies, 85
Indian Reservations, 74
  air quality, 41, 43, 45, 47, 74
  hazardous waste disposal, 74
  water quality, 66, 67, 74
Indian Tribes
  water rights, 77

LAER, see *Lowest Achievable Emission Rate*
Lakes, Rivers, Streams, and Wetlands
  alteration of lake area or shore, 60
  alteration of stream, 67, 68
  dam safety, 72
  navigable waters, 75
Lakeshore Development Permit, 14, 18, 21, 24, 27, 60, 75
Land Use Regulations, see also *Planning and Zoning*
  bioenergy projects, 3, 5, 6, 20, 37, 51, 74, 75
  floodplains and floodways, 14, 18, 21, 24, 27, 60, 75
  lakeshores, 14, 18, 21, 24, 27, 60, 75
  local areas, 74-75
Landfill, 28, 48, 55
Landfill Gas, xi, 2, 10, 11, 31-32, 40, 51
Lead, 42, 43, 44, 46, 47
Liquefaction, xi, 2, 10, 11, 33-34, 40, 49, 51
Lowest Achievable Emission Rate (LAER), 46

MACT, see *Maximum Available Control Technology*
Major Facility Siting, 5, 21, 33, 51, 61
Maximum Available Control Technology, 46
Mechanical Permit, 5, 14, 18, 21, 23, 24, 27, 30, 31, 35, 37, 51, 57, 74
Mercury, 42
Methane, xii, 10, 16, 17, 28, 29, 31, 32
Methanol, xii, 10, 28, 29, 43, 49
MGWPCS Permit, see *Montana Groundwater Pollution Control System Permit*
Mill Residues, 10, 22, 23, 25, 26, 29, 33, 34, 38, 93, 94, 96
Montana Administrative Procedures Act, 54, 64
Montana Ambient Air Quality Standards, 41, 42, 43, 44, see also *National Ambient Air Quality Standards*
Montana Clean Air Act, 41, 54
Montana Environmental Policy Act, 39, 54, 60, 64, 65
Montana Groundwater Pollution Control System (MGWPCS) Permit, 5, 12, 14, 18, 19, 21, 22, 24, 25, 27, 28, 33, 37, 48, 50, 65-66
Montana Growth Through Agriculture Program, 6, 86
Montana Hazardous Waste Act, 48-50, 63-64
Montana Pollutant Discharge Elimination System (MPDES), 5, 12, 14, 16, 18, 21, 24, 27, 48, 50, 66
Montana Safety Act, 75
Montana Science and Technology Alliance, 6, 86
Montana Solid Waste Management Act, 64-65
Montana Water Quality Act, 22, 25, 28, 33, 37, 48, 65-66
Montana Water Use Act, 68-69,77

MPDES, see *Montana Pollutant Discharge Elimination System*
Municipal Waste, see *Solid Waste—municipal*

NAAQS, see *National Ambient Air Quality Standards*
National Ambient Air Quality Standards, 19, 25, 41, 43, 44, 46, 47, 55, 77
National Pollutant Discharge Elimination System (NPDES), 5, 14, 18, 21, 24, 27, 66, 67, 74
Natural Streambed and Land Preservation Act, 68
Navigable Waters, 75
Nitrogen Oxides, 29, 40, 42, 43, 44, 46
Noise, Occupational, 76
Nonattainment Permitting Requirements, xii, 14, 18, 21, 24, 27, 43, 46, 77
NPDES, see *National Pollutant Discharge Elimination System*

Occupational Safety and Health, 62-63, 75-76
  air pollution, indoor, 76
  boilers and boiler operators, 14, 15, 18, 20, 21, 24, 27, 30, 33, 62
  federal rules, 75-76
  fire safety inspections, 14, 18, 21, 24, 27, 63, 74-75
  occupational noise, 76
  standards, 14, 18, 21, 24, 27, 75-76
  state programs, 75-76
Odor Control, 12, 14, 16, 18, 19, 21, 22, 24, 27, 28, 31, 33, 37, 42
Oilseed Extraction, xii, 2, 10, 11, 35-36, 40, 51, 94
Open Burning Permit, 6, 42, 54-55, 75, 76
OSHA, see *U.S. Occupational Safety and Health Administration*
Ozone, 42, 43, 44, 46

Particulates, xii, 13, 17, 20, 23, 26, 29, 34, 35, 36, 37, 38, 40, 41, 42, 43, 44, 46, 47, see also *PM-10 Ambient Air Quality Standards* and *Total Suspended Particulates*
Pellet Plants, see *Densification* and *Wood Pellet Plants*
Pellets, see *Densification* and *Wood Pellets*
Phenol, 49
Phosphorus, 42
Planning and Zoning
  bioenergy projects, 2-7, 20, 27, 33, 35, 46
  local areas, 75-76
Plumbing Permit, 5, 14, 18, 21, 23, 24, 27, 30, 31, 35, 37, 51, 58, 74
PM-10 Ambient Air Quality Standards, 12, 14, 16, 18, 21, 22, 24, 25, 27, 28, 35, 37, 40, 42, 43, 44, 46-47, 77, see also *Particulates*
Prevention of Significant Deterioration (PSD), xii, 14, 18, 19, 21, 24, 25, 27, 41, 43, 45, 46, 55
PSD, see *Prevention of Significant Deterioration*
Pyrolysis, xii, 2, 10, 11, 37-38, 40, 49, 51

Qualifying Facility, xii, 21, 27, 71

Rapeseed, see *Canola*
Refuse-Derived Fuel, xiii, 12, 16, 19, 20, 22, 23, 25, 26, 28, 29, 33, 34, 37, 38, 47
Resource Conservation and Recovery Act, 48

Safety, see also *Fire Safety Inspections* and *Occupational Safety and Health*
  alcohol plants, 12
  anaerobic digestion, 18
  landfill gas, 31
Safflowers, 10, 35, 36, 94, 96, 102
Sawmill Wastes, see *Mill Residues*
Sewage Treatment Facilities, 16, 75
SIP, see *State Implementation Plan*
Skygas, 28
Slash Removal Permit, see *Timber Removal Permit*
Solid Waste, see also *Refuse-Derived Fuel* and *Waste*
  disposal, 12, 16, 19, 22, 25, 28, 33, 35, 37, 40, 47-50, 94
  municipal, 17, 20, 26, 29, 34, 38, 94, 104
Solid Waste Management Act, see *Montana Solid Waste Management Act*

Solid Waste Management System License, 12, 14, 16, 18, 19, 21, 22, 24, 25, 27, 28, 33, 35, 37, 47, 64-65
Solid Waste Resources, 94, 96, 104
Special Occupations Tax, 14, 15
State Implementation Plan (SIP), 43, 47
Straw, 12, 13, 16, 25, 26, 94, 99-101
Stream Protection Act Permit, 14, 18, 21, 24, 27, 67
Streambed and Land Preservation Permit, 14, 18, 21, 24, 27, 68
Sulfur Dioxide, 29, 32, 40, 42, 43, 44, 46, 47
Sunflowers, 10, 35, 36, 96

Tax Incentives
  gasohol, 14, 15, 56
  property tax reductions, 14, 15
Taxation
  electrical energy producer's tax, 18, 21, 24, 27, 30, 72
  gas well license tax, 31
  gasoline license tax on gasohol sold in Montana, 14, 15
  special occupations tax, 14, 15
Timber—Cutting, Sales, Stand Improvement, see *Forests and Forestry*
Timber Removal Permit, 23, 24, 27, 30, 33, 37, 59, 73
Total Suspended Particulates (TSP), xiii, 40, see also *Particulates*
Transportation, 73-74
  hazardous wastes, 48, 49, 73-74
  motor carriers, 73
  wood pellets, 24
TSP, see *Total Suspended Particulates*

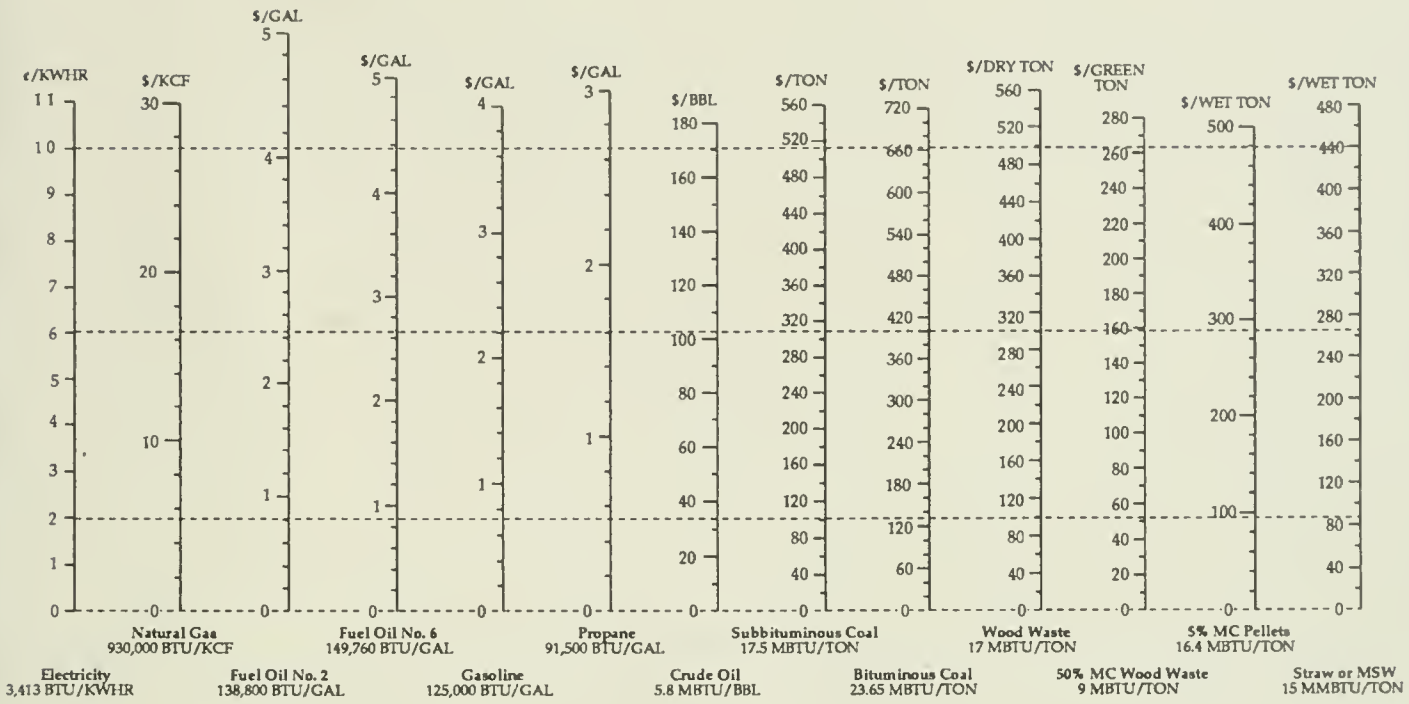
Underground Storage Tanks, Leaking, 49
U.S. Bureau of Alcohol, Tobacco, and Firearms, 14, 15, 56, 90
U.S. Federal Energy Regulatory Commission, 21, 71-72, 92
U.S. Occupational Safety and Health Administration, 92, see also *Occupational Safety and Health*
Utilities
  cogeneration, 2, 10, 11, 19, 20, 21, 25, 26, 40, 51, 71-72
  electric cooperatives, 21, 72, 83-85
  lines, 73, 75
  mains, 73, 75

Vinyl Chloride, 42

Warehouseman's License, 14, 15, 36, 53
Waste
  disposal, 3, 6, 12, 47-50, 63-65, 94
  garbage dumps, 31
  hazardous wastes, 12, 16, 19, 22, 25, 27, 28, 33, 35, 37, 48-50, 63-64, 73-74
  Indian reservations, 74
  landfills, 48
  solid wastes, nonhazardous, 12, 13, 16, 17, 19, 20, 22, 25, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, 47-48, 64-65
Water Pollution Control Act, 67
Water Quality, 50, 65-68
  animal confinement facility, 16, 66
  discharge of pollutants, 6, 35, 37, 40, 48, 50, 74
  pollution, groundwater, 12, 48, 50, 65-66, 74
  pollution, surface water, 12, 48, 50, 66, 67, 68, 74
Water Quality Act, see *Montana Water Quality Act*
Water Rights, 51, 68-69, 77, 87
Water Use, 51, 68-69, 77
Wood Pellet Plants, 22, 23, 24, 81, 93
Wood Pellets, 22, 23, 24, 93, 96
Wood Resources, 25, 93-94, 95, 96
Wood Stoves, 22, 25, 76
Wood Waste, 10, 19, 20, 22-23, 25, 26, 29, 33, 34, 38, 42, 73, 93

Zoning, see *Planning and Zoning*
Zoning Permit, 5, 75

MONTANA ENERGY COST COMPARISON CHART



BBL = barrel
BTU = British thermal unit
CF = cubic foot
GAL = gallon
K = 1,000
KWHR = kilowatt hour
LB = pound
M = 1,000,000
MC = moisture content
MSW = municipal solid waste
TON = 2,000 pounds

Sources of energy equivalents:
Natural gas—average content of gas from Montana's eight most populated cities.
Electricity, fuel oils, gasoline, propane, crude oil, and coals—DNRC, *Montana Historical Energy Statistics*, Sixth Edition, December 1989.
Wood wastes and wood pellets—DNRC reports and tests.
Straw energy content—Miles 1988.
MSW or trash energy equivalents—DNRC tests 1989.

How to Use This Chart

This chart allows quick comparison of the costs of various Montana fuels. For example, to compare the cost of green wood waste to No. 2 heating oil at $0.80 per gallon, draw a horizontal line across the chart, which shows the equivalent cost of wood waste at 50 percent MC to be $52 per ton. These costs are comparable on an energy content basis since the efficiencies of boilers tested by DNRC show fuel oil and wood waste burners to operate at about the same efficiency.

Fuel switching usually is not based on fuel savings alone. Other cost factors to be considered include maintenance, storage, environmental requirements, disposal costs, and the local economy.

Department of Natural
Resources and Conservation
Energy Division
1520 East Sixth Avenue
Helena, MT 59620-2301